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**The Archipinae
of North America
(Lepidoptera: Tortricidae)**

by

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Insect Systematics and Biological Control Unit
Entomology Division, Ottawa, Canada

THE CANADIAN ENTOMOLOGIST

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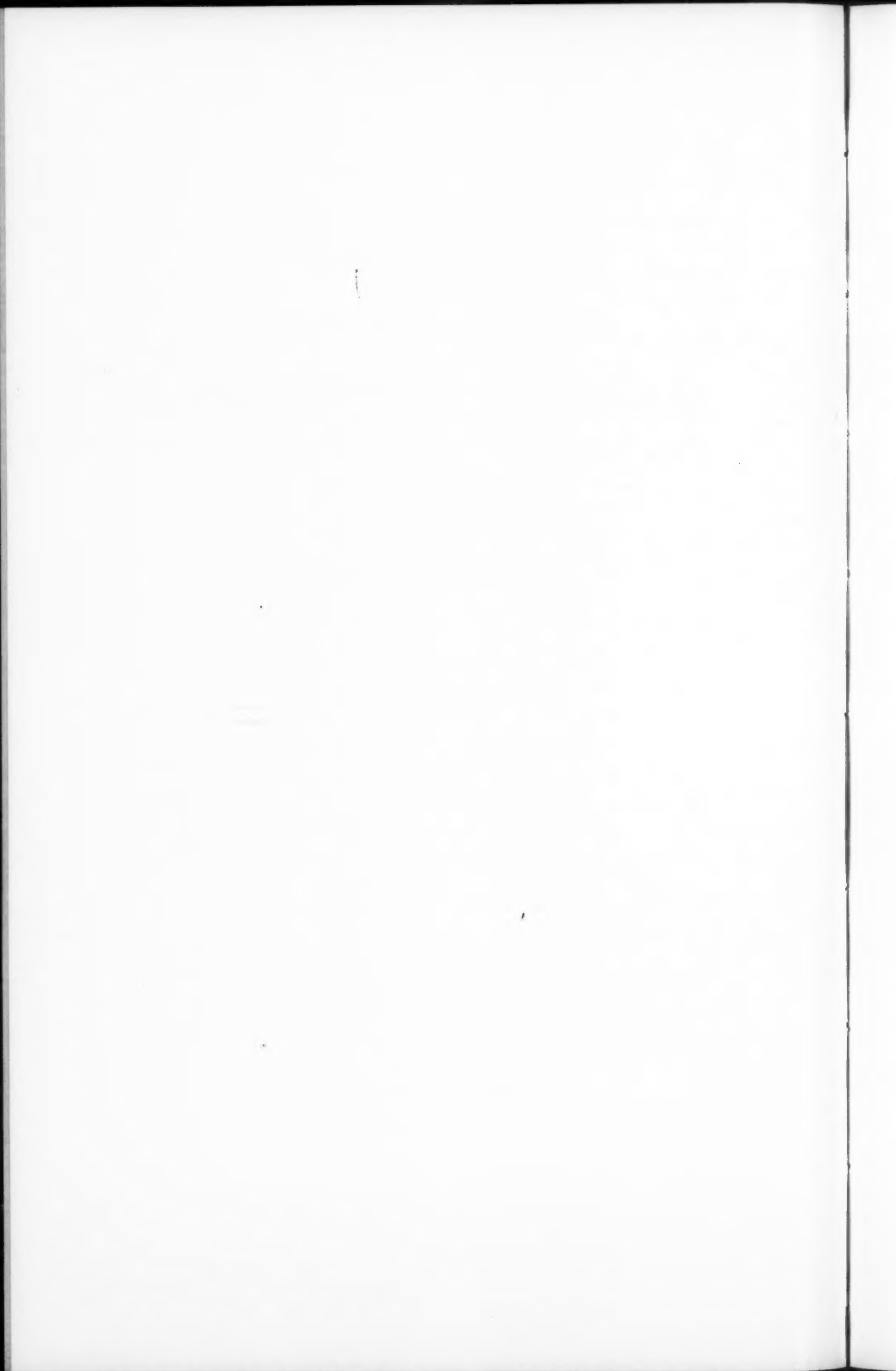
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The Archipinae of North America (Lepidoptera: Tortricidae)¹

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The subfamily Archipinae, as represented in North America, comprises a group of 72 described species of moths, varying in wing expanse from one-half of an inch to one inch. In several species, the costal margin of each forewing is sinuous, and when the moth is resting, its outline roughly corresponds to that of a bell. Hence, these moths are sometimes referred to as the bell moths. The larvae feed on the foliage of many species of coniferous and deciduous plants; and as they feed, they bind, crumple, or roll the leaves together to form a shelter. From this habit the larvae are commonly called leaf rollers or leaf tiers, and they often occur abundantly enough to cause considerable injury to plants of economic value. The most destructive of these at the present time are the spruce budworm, *Choristoneura fumiferana* Clem., and a closely allied species, *C. pinus* Free., the jack-pine budworm. Both of these species present a major control problem to those interested in the preservation of the spruce, balsam, and jack-pine stands of the forested regions. The defoliation of individual trees, and of large stands, is often so severe that it causes the death of numerous trees. This results in a loss of valuable timber, provides situations for other insects and plant diseases to develop, and increases the fire hazard in the forested regions.

No satisfactory classification of this group of moths has been presented in the past, and in consequence the identification of the various species, as well as the establishment of their relationship to one another, was difficult and often impossible. The purpose of this study is to present a classification based on the external anatomical structures of the adults, supplemented with all available biological data, including food plants, ecology, and geographical distribution.

An ideal classification would include a systematic arrangement of the immature stages, but in this group the food plants and the larvae of many species are unknown. Therefore, such a classification is not practical until more adequate knowledge is available. There is, however, on the basis of the few larvae and pupae available, an indication that the setal arrangement of the larvae, the shape of the cremaster, and the spining of the pupae may form a basis for the identification of species groups.

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²Entomologist.

I wish to express my sincere appreciation to the following, who kindly placed at my disposal the historic lepidopterous collections in their charge, and who generously assisted with the loan of valuable material for study: Mr. C. F. W. Muesebeck, and the late Mr. Carl Heinrich, and Mr. August Busck of the United States National Museum, Washington, D.C.; the late Dr. E. P. Darlington, New Lisbon, N.J.; Dr. F. M. Jones, Wilmington, Del.; the late Dr. E. T. Cresson, Jr., Philadelphia Academy of Natural Sciences, Philadelphia, Pa.; Dr. M. Cazier, Dr. A. B. Klots, Dr. C. H. Curran, and Mr. W. P. Comstock, American Museum of Natural History, New York, N.Y.; Dr. J. C. Bequaert and Dr. W. T. M. Forbes, Museum of Comparative Zoology, Cambridge, Mass.; Mr. V. Nabokov, Cornell University, Ithaca, N.Y.; and Mr. H. K. Clench, Carnegie Museum, Pittsburg, Pa.

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HISTORICAL REVIEW

The first noteworthy systematic arrangement of the Tortricidae was proposed in 1863 by Heinemann (*Die Schmetterlinge Deutschlands und der Schweiz*). His classification was based upon wing venation, wing shape, presence or absence of the male costal fold, length and direction of palpi, and thoracic scale-tufting.

Peyerimhoff (1876, *Ann. Soc. Ent. France* 6: 523-546) discussed the external anatomy such as scales, ocelli, palpi, and wing veins; and although he presented a fine critical review of the gross structures of the Tortricidae, he was unable to suggest an arrangement more satisfactory than the difficult Heinemann system. However, he discontinued using the male costal fold as a generic character and in this view was supported by Barrett in 1885 (*Ent. Mo. Mag.* 22: 1-6).

Walsingham, in 1879, (*Ill. Lep. Het.* 4), followed Heinemann's system but used the latter's subgenera as genera. The work of Kearfott and Clemens consisted almost entirely of specific descriptions, and for many of their species they gave only tentative generic references.

The first genitalic studies were made by Dampf in 1908, (*Iris* 21: 304-329). He considered that the different planes of union of the tegumen with the vinculum and the upper edge of the clasper, as well as the presence or absence of the "penisblindsack", adequately separated the subfamilies Tortricinae and Olethreutinae.

Meyrick, in 1913, (*Gen. Insect. Fasc.* 149) followed Heinemann but omitted the costal fold and wing shape.

The long-awaited revisions of Fernald, and later of Busck, never appeared, and the former's catalogue in Dyar 1902, (*List of North American Lepidoptera*) was merely an attempt to apply the Heinemann system to the North American species. Fernald, however, did much toward eliminating the vexatious nomenclatorial tangles by designating the genotypes of the numerous tortricid genera in 1908, (*The Genera of the Tortricidae and Their Types*).

Walsingham and Durant, in 1915 (Biol. Cent. Amer. Lep. Heter. 4), were unable to recognize any generic characters and consequently grouped the bulk of the Central American species under the genus *Tortrix* Linn. on the basis of wing venation.

The Palaearctic species were similarly treated by Kennel in 1921 in his voluminous monograph, (Die Palaarktischen Tortriciden), and were placed largely in the two genera *Tortrix* Linn. and *Cacoecia* Hbn.

Forbes, in 1923 (Cornell Univ. Agri. Expt. Sta. Mem. 68), largely followed Meyrick's system and divided the bulk of the species of this group into two genera, *Tortrix* Linn. and *Archips* Hbn. This division was based on the shape of the labial palpus. He further divided these genera on the presence or absence and shape of the male costal fold, and thus reverted to the long-used Heinemann system.

Pierce and Metcalf, in 1923, (The Genitalia of the Tortricidae of the British Isles), presented a classification based on characters in the male and female genitalia. This has proved the most usable and most satisfactory arrangement yet proposed, but they restricted their studies to the limited fauna of the British Isles and consequently grouped together well-defined genera.

The arrangement in McDunnough's check list of 1939, (The Lepidoptera of Canada and the United States of America), merely follows the Fernald arrangement as listed in the Barnes and McDunnough check list of 1918, with a slight change in generic names and synonymic additions.

The Heinemann system was difficult or impossible to apply, because of the variation of palpal length and direction; and though an artificial classification based on a secondary sexual character such as the male costal fold is possible, only the male sex may be classified. Even such characters as those of wing venation, which form the current basis for most of the family classification of the whole order of Lepidoptera, are not infallible. It has been recently observed that, on the basis of wing venation alone, certain species of the tortricid subfamily Sparganothinae would be placed in the Eucosmidae. Numerous other characters, however, are more reliable indicators of taxonomic positions. In the Lepidoptera the genitalia are paramount for the differentiation of genera, although not always a criterion for the recognition of species. In the Archipinae, as in most Lepidoptera, the genitalia are complex structures, composed of many parts. The aggregate of differentiation in these is reasonably assumed to be of more importance than any single character in other parts of the body.

The arrangement of genera in the following classification is based primarily on characters in the male and female genitalia. These are correlated with other structures, such as the dorsal abdominal pits (Fig. 202) and wing venation. All characters must be evaluated, and a particular character may be of generic value in one species group but only of specific value in another group.

MATERIAL STUDIED

This study has been based mainly on the specimens in the Canadian National Collection, Ottawa, Can.; the United States National Museum, Washington, D.C.; the Philadelphia Academy of Natural Sciences, Philadelphia, Pa.; the American Museum of Natural History, New York, N.Y.; the Museum of Comparative Zoology, Cambridge, Mass.; and the private collections of the late Dr. E. P. Darlington, New Lisbon, N.J.; and Dr. F. M. Jones, Wilmington, Del.

The existing type specimens of nearly all of the described North American species have been studied to establish the identity of each species. Notes ob-

tained from the authorities of the British Museum of Natural History, London, England, on the types of the species described from North America by Wallingham and Walker, have helped in establishing the identities of those species. In addition, the type species of all the tortricid genera have been examined to assign the correct generic name to each archipine genus. The genitalia, of most of the type species of the genera considered in this paper, are illustrated as well as the various species of each genus.

METHOD OF APPROACH

The basis of the present classification is that of comparative morphology, with particular reference to the male and female genitalia. All the genera and most of the species, except those in *Argyrotaenia*, have been defined by this method. However, there is an indication that a complex of sibling species exists in most of the larger genera; and though these are indicated on the basis of comparative morphology, their biological status could be more readily ascertained by a study of their behaviour, with particular reference to isolating mechanisms. These represent special problems for further investigation and will be mentioned in the text wherever they occur.

No attempt has been made to assemble a complete bibliography for each species, and only North American references to the taxonomic history are included. The writer does not feel qualified to verify or criticize the present European synonymy. References to the extensive economic literature on many of the species have been omitted, largely because of the misidentifications involved, and the considerable and often impossible task of making correct nomenclatorial associations. These economic references may be readily obtained by consulting Colcord's indices of American Economic Entomology.

Throughout this paper, I have omitted the brackets associated with the author's name where a generic transfer of a specific name has occurred. I have not adhered to the opinion of the International Commission on Zoological Nomenclature that recommends its usage in such cases. About 95 per cent of lepidopterous species have been generically transferred since their original descriptions, and I agree with the practice, prevalent among many taxonomists, of discontinuing the use of brackets. Further, the method of listing such transfers under each specific name, as employed in the text, reveals the taxonomic history at a glance.

ANATOMICAL VARIATION

This group of moths is rather homogeneous in general structure but presents some rather striking anatomical variation in certain body regions.

The labial palpi vary in length and direction. They may be porrect and long with straight segments, or may ascend toward the frons as a result of the upward curving of the two basal segments. Almost every intermediate condition exists, and a classification employing these characters is impractical.

The basal segments of the antennae are simple, or fused, enlarged, and deeply notched inwardly as in the males of the genus *Pandemis* Hbn. (Fig. 2A). The scape rarely possesses a strong tuft of elongated scales. The variation of wing pattern will be discussed in the definition of the subfamily. In the males of many species throughout the subfamily, the costal margin near the base is extended and folded backward. The extension varies greatly in length and width, is referred to as the costal fold, and is a secondary sexual character of specific value only. The wing venation is only slightly variable in the North American species. The only deviation from the *Choristoneura* Led. type, (Fig. 29) is the stalking of the fourth and fifth radial veins, about halfway between the discal cell and the apex of the fore wing. This condition exists only in

the small genera *Adoxophyes* Meyr. and *Batodes* Gn., and in the latter genus also, is a short stalking of medius 3 and cubitus 1 of the hind wing.

The thorax is often tufted with elongate scales arising from the posterior margin of the mesoscutellum. This character is usually present in the genus *Argyrotaenia* Steph. and has been used in the past to distinguish that genus. However, this tuft is not always present and is only of specific significance.

In both sexes of all the species of the genus *Archippus*, a genus described later in this paper, and of most of the species of *Archips* Hbn., the dorsum of the second, and sometimes of the third abdominal segment, possesses a pair of deep, round pits, (Fig. 202). These pits are also present in the pupal case, and are found sporadically in other subfamilies of Tortricidae. The function of these pits is unknown to me. In the males of most species of the genus *Pandemis* Hbn., the venter of the second abdominal segment shows a specialization. On each side is an invagination enclosing a hair-pencil of long scales; and outwardly, on each side, is an elongate area of short, blackish, triangular scales (Fig. 2 B). The hair-pencil is apparently everted during courtship. It is a secondary sexual character useful in the definition of a species group or subgenus, and represents an unusual development.

Great variation between species is found in the male and female genitalia (Figs. 1-93). In the Archipinae, the characters found in these structures are extremely valuable in the definition of genera and species.

In the male genitalia, the uncus varies from long and spoon-like (Fig. 19) to short and hood-like (Fig. 52). It is either broadly (Fig. 19) or narrowly (Fig. 37) attached to the tegumen. The socii are well developed, long and drooping (Fig. 27), or small and knob-like (Fig. 36), or absent (Fig. 19).

The apices of the arms of the gnathos are narrowly joined (Fig. 42), or broadly fused and flat (Fig. 50), or blade-like (Fig. 49). The transtilla has the form of a simple (Fig. 23) or twisted band (Fig. 7). It either articulates with the ventral edge of the tegumen, the dorsal apex of the vinculum, and the dorsal base of the clasper, or is divided and dentate, and arises apparently from the inner surface of the clasper (Fig. 50). The claspers are broad and rounded (Fig. 13), triangular (Fig. 44), or irregular in outline (Figs. 51 and 52). The sacculus is short, narrow, and simple (Fig. 44), toothed apically (Figs. 12-17), or broad and simple throughout (Fig. 34). The membrane of the eighth abdominal segment sometimes bears a ventral pair of long hair-pencils, the coremeta (Fig. 2).

The aedeagus is pistol-shaped or arcuate, smooth or dentate, with a variable number of cornuti which exhibit great diversity of length and width. They are usually deciduous, but appear to be permanent in *Batodes angustiorana* Haw. (Fig. 22).

The female genitalia vary chiefly in the length and sclerotization of the ductus bursae and in the shape of the plates surrounding the ostium. The anterior area of sclerotization at the junction of the ductus with the eighth ventral plate is referred to as the antrum. It is usually trough-like and can be better understood by reference to Figs. 65 and 73. The sterigma is either open as in Fig. 73, or closed and funnel-like as in Fig. 67. This region is extremely variable and presents characters of considerable taxonomic value.

PHYLOGENY AND DISTRIBUTION

The subfamily Archipinae is not represented in the fossil record, and any attempt to speculate on the phylogenetic and distributional history of the group must be based on morphological and geographical data. Conclusions

based on such grounds are always somewhat dubious because the ancestors of the group have been subjected to the catastrophic climatic and biotic changes that have affected the land masses since late Mesozoic times. Among these, the great marine invasions and the Pleistocene glaciation of the northern hemisphere have, no doubt, had a marked effect upon the development and distribution of the group.

The subfamily is widely distributed in the Holarctic region, and the genus *Adoxophyes* Meyr. extends into the Indo-Australian region, where its specific representation is the most numerous. The South American tortricids have not been adequately studied. A few of the African species which the writer has examined appear to be generically distinct from those indigenous to the more northern areas. This rather general distribution of the group, as outlined above, probably represents a very early origin and a wide distribution of the ancestral archipoid stocks, if the zoogeographical theory of age and area is well founded.

Comparative anatomy must be analysed for evidence revealing the specialized or generalized condition of any character before it is of value in suggesting phylogenetic relationships. It appears reasonable to assume that a character common to most of the species of a group, is a heritage from their common ancestry and is, therefore, a primitive condition. A difficulty naturally arises in the evaluation of characters that are phylogenetically significant. It appears to be a fair assumption that the forking of the veins R_4 and R_5 in the fore wing of the genus *Adoxophyes* Meyr. represents a departure from their usual separate origin and, by the application of the above principle, a specialized condition. Correlated with this is the spinose and divided condition of the transtilla, a condition found also in *Ptycholoma* Steph. and *Clepsis* Gn., but the last two genera lack the forking of R_4 and R_5 .

Each genus is apparently characterized by a particular specialized development. Those genera showing the greatest degree of anatomical similarity have been placed together, and on this basis there appear to have been two general trends of development. One trend is represented by *Archips* Hbn., *Archippus* (described later in this paper), *Pandemis* Hbn., and *Choristoneura* Led., and it is characterized by the simple, band-like transtilla; the long, spoon-like uncus; and the long ductus bursae, which is usually strengthened by the development of a thin, sclerotized ribbon. The other trend is indicated by a spinose transtilla, which is often divided, and is often supported by a heavily sclerotized extension of the inner side of the clasper. The uncus is usually inclined downward. The females of this generic group possess a much shorter ductus bursae and the sclerotized ribbon is usually absent. This trend is represented by the genera *Ptycholoma* Steph., *Adoxophyes* Meyr., and *Clepsis* Gn. The remaining genera, *Syndemis* Hbn., *Batodes* Gn., and *Argyrotaenia* Steph., represent a somewhat intermediate line of development, tending toward the ancestral stem of the *Archips-Choristoneura* stock.

TYPE SPECIES OF ARCHIPINE GENERA

All genotypic designations have been considered from a nomenclatorial aspect only, without regard to any biological consideration. The genotypic designations have been subjected to the application of Article 30 of the International Rules of Zoological Nomenclature, as well as the related subsequent opinions of the International Commission on Zoological Nomenclature. Opinion 97 of the Commission, which invalidates the so-called Tentamen genera of Hübner, as of 1806, has been followed, and the Tentamen genera involved are consequently dated from Hübner 1822, (Syst.-alph. Verz.). This work contains the next usage of those generic names.

Fernald, in 1908, assisted a great deal in clarifying the numerous nomenclatorial problems that existed. His designations, however, require verification, and some have been invalidated by subsequent nomenclatorial opinions. The described genera are as follows, and are arranged alphabetically for convenience.

***Adoxophyes* Meyrick**

1881. Proc. Linn. Soc. New South Wales 6: 429. Monobasic.

Type species: *Adoxophyes heteroidana* Meyrick.

***Archips* Hübner**

1822. Syst.-alph. Verz., pp. 58-66 included *xylosteana* Linn. and 36 other species.

Type species: *Phalaena Tortrix xylosteana* Linn. Selected by Obraztsov, 1954. (Tijds. v. Ent. d. 97: 179).

Walsingham (1897. Proc. Zool. Soc. Lond.: 133) designated *piceana* Linn. as the type of *Archips* Hbn. This name was not included in the original 37 species and consequently is not available.

***Argyrotaenia* Stephens**

1852. List Specimens Brit. Mus. 10: (Lep.) 67 included *politana* Haw. and two other species.

Type species: *Tortrix politana* Haworth. Selected by Fernald (1908, p. 36).

***Batodes* Guenée**

1845. Ann. Soc. Ent. France (2) 3: 174. Monobasic.

Type species: *Paedisca dumeriliana* Duponchel (= *angustiorana* Haworth).

***Clepsia* Guenée**

1845. Ann. Soc. Ent. France (2) 3: 168. Monobasic.

Type species: *Tortrix rusticana* Treitschke.

***Choristoneura* Lederer**

1859. Wien. Ent. Mon. 3: 242 included *diversana* Hbn. and four other species.

Type species: *Tortrix diversana* Hübner. Selected by Fernald (1908, p. 37).

***Pandemis* Hübner**

1825. Verz. bekannt. Schmett. 388 included *textana* Hbn. and nine other species.

Type species: *Tortrix textana* Hübner (= *corylana* Fabr.). Selected by Fernald (1908, p. 15.)

***Ptycholoma* Stephens**

1829. Syst. Cat. British Ins. 2: 183. Monobasic.

Type species: *Phalaena Tortrix lecheana* Linn.

***Syndemis* Hübner**

1825. Verz. bekannt. Schmett. 382 included *musculana* Hbn. and seven other species.

Type species: *Tortrix musculana* Hbn. Selected by Fernald (1908, p. 11).

DEFINITION OF THE SUBFAMILY ARCHIPINAE

Small to medium-sized moths with wing expanse from 13 to 34 mm., and often with the costa of the forewings sinuous to suggest a bell-shaped appearance when the moth is at rest.

The forewing has a characteristic pattern consisting of a dark basal patch that, when complete, extends from the costa to the posterior margin, and occupies the basal one-fifth of the wing. The median band, which obliquely crosses the wing near the middle, typically extends from the middle of the costa to near the outer angle of the posterior margin, or tornus. A lunate or triangular costal spot occurs about half-way from the median band to the apex. This is referred to as the outer costal spot, and it is often extended toward the tornus. The bands are often broken into numerous, coalescing spots.

Wing venation usually as in Fig. 29. Base of cubitus of hind wing without a fringe or hair-tuft on the upper side; R_4 and R_5 of fore wing free, rarely stalked; R_5 running to the outer margin or to the apex; M_3 and Cu_1 of hind wing separate, rarely stalked; costal fold often present. Palpi ascending or porrect. Thorax sometimes with a posterior crest. Basal joint of antenna normal, rarely enlarged and notched on the inner side. Male genitalia with broad claspers and well-developed sacculus; uncus well developed, spoon-shaped,

blunt; gnathos in the form of two curved or elbowed arms joined at their apices; socii well developed, aborted, or absent; transtilla well developed, entire as a simple band, dentate, or divided; cornuti deciduous or rarely permanent. Female genitalia with flattened ovipositor lobes; signum of bursa in the form of a single, smooth horn with a bulbous base; base of ductus bursae often sclerotized and referred to as the antrum; sterigma often funnel-like.

KEY TO GENERA OF THE SUBFAMILY ARCHIPINAE

1. Abdomen with dorsal pits near the base (Fig. 202)..... 2
Abdomen without dorsal pits..... 3
2. Male with uncus long, the apex emarginate and gradually tapering from the base; (Figs. 6-11). Female with the plate behind the ostium terminating in a median and two lateral membranous lobes (Figs. 53-58)..... *Archippus* nov. gen.
Male with uncus spoon-shaped, with rounded apex (Figs. 12-17). Female without such lobes, but with scale tufts on each side of the plate behind the ostium (Fig. 69)..... *Archips* Hbn.
3. Male with basal joints of antenna fused and deeply notched on the inner side (Fig. 2A). Female with ventral lip of sterigma convex, and ductus bursae entirely membranous (Fig. 60)..... *Pandemis* Hbn.
Male with basal joints of antenna simple, not notched on the inner side. Female with ventral lip of sterigma concave (Fig. 64) or straight (Fig. 72) or if convex then ductus bursae with sclerotized ribbon (Fig. 62)..... 4
4. Uncus of male strongly tapered basally to join the tegumen narrowly (Fig. 35). Female with ventral lip narrow so that the ostium is open to view and the membrane behind it visible (Fig. 73)..... *Choristoneura* Led.
Male with base of uncus widened and joining the tegumen broadly (Fig. 13). Female with ventral sclerotized lip of ostium wider, or the sterigma not membranous behind (Figs. 62 and 68)..... 5
5. Sacculus of male terminating in a blunt, upright tooth near the outer margin of the clasper (Fig. 13). Transtilla not dentate. Dorsal sterigma plate of female with a scale tuft on each side..... 6
Sacculus of male not terminating in a blunt tooth as above or if so, then transtilla dentate (Fig. 47). Female without scale tufts on sterigma..... 7
6. Males..... *Archips* Hbn.
Females: Ventral lip of sterigma concave; ductus bursae usually with sclerotized ribbon..... *Archips* Hbn.
Ventral lip of sterigma straight; ductus bursae always membranous (Fig. 72)...... *Syndemis* Hbn.
7. Fore wing with R_4 and R_5 stalked half-way between the cell and the wing apex..... 8
Fore wing R_4 and R_5 arising separately from the cell..... 9
8. Hind wing with M_3 and Cu_1 stalked..... *Batodes* Gn.
Hind wing with M_3 and Cu_1 separate..... *Adoxophyes* Meyr.
9. Transtilla of male not spinose or dentate; female with antrum consisting of two small, isolated, lateral plates (Fig. 82)..... 10
Transtilla of male spinose or dentate (Fig. 50). Female with antrum not as above..... 11
10. Females..... *Argyrotaenia* Steph.
Males: Sacculus broad, extending almost to the apex of the clasper; cornuti half as long as aedeagus (Fig. 23)..... *Syndemis* Hbn.
Sacculus narrow, gradually tapering toward the apex; cornuti short, numerous, compact, not more than one-quarter as long as the aedeagus (Fig. 40)..... *Argyrotaenia* Steph.
11. Clasper of male directed ventrad; sacculus short; transtilla finely spinose (Figs. 44-46). Sterigma with a small sclerotized plate (Fig. 85) or a spined area (Fig. 84)..... *Psycholoma* Steph.
Clasper of male not as above; sacculus longer or terminating in a tooth; transtilla coarsely spinose or dentate (Figs. 47-52). Sterigma variable but not with such a plate or spined area (Figs. 88-93)..... *Clepsis* Gn.

PANDEMIS Hübner

Pandemis Hubner, 1825, Verz. bekannt. Schmett., p. 388.

Fernald, 1908, The genera of the Tortricidae and their types, p. 15.

Meyrick, 1913, Gen. Insect., Fasc. 149: 41.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 489.

Palpus triangular, beak-like. Basal joints of male antenna fused and notched on inner side (Fig. 2A). Costal fold absent.

Male genitalia of type species, *corylana* Fabr. (Fig. 1). Claspers broad, with heavy coremeta (Fig. 2) in sclerotized pouches; sacculus to the outer margin of clasper; transtilla a simple band; uncus broad; socii long, drooping; aedeagus boomerang-like; cornuti two, large, slightly more than half the length of the aedeagus, and set in sclerotized ring-like bases. Female genitalia of type species (Fig. 59). Sterigma with a long ventral hood and a small scale tuft on either side; antrum, trough-like; ductus bursae membranous.

The genus is divided into two species groups, separated by the degree of specialization of male secondary sexual characters.

Key to Species of *Pandemis* Hübner

1. Male with two elongate areas of specialized black scales on the sternal region of the second abdominal segments (Fig. 2B); these are usually obscured by the meta-thoracic coxae. Uncus wider at base than at apex. Female with outer costal spot unicolorous 2
 Male without such specialized scales. Apex of abdomen of male with distinct black scale tufts protruding beyond the genitalia. Female with inner edge of outer costal spot black. *lamprosana* Rob.
2. Hind wing of both sexes entirely white above *pyrusana* Kft.
 Hind wing fuscous, at least on basal half. 3
3. Male with hind wing entirely fuscous. Fore wing of both sexes with a purplish cast *canadana* Kft.
 Male with hind wing fuscous in posterior half only. Fore wing reddish-brown *limitata* Rob.

Pandemis lamprosana Robinson

Figs. 100-101

Tortrix lamprosana Robinson, 1869, Trans. Am. Ent. Soc. 2: 264, Plate 1, Fig. 5.

Pandemis lamprosana Robinson, Fernald, 1902, in Dyar, List No. Am. Lep., p. 482.

Meyrick, 1913, Gen. Insect., Fasc. 149: 27.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 499.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 569.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 414.

Fore wing reddish-brown, with darker basal patch and median fascia narrowly bordered with luteous; outer costal spot with the inner edge suffused with black scales; fringe concolorous with wing apex. Male with protruding black scale-tufts at apex of abdomen. Hind wing usually shining white, often with fuscous anal area and ochereous apex; fringe shining white, often ochereous at wing apex. Expanse: male, 19-22 mm.; female, 24-28 mm. Moth in June and July.

Male genitalia (Fig. 5).—Uncus broad, gradually tapering toward base. Aedeagus with subapical, dorsal, dentate crest.

Female genitalia.—As in *limitata* Rob. (Fig. 60).

Type locality.—Pennsylvania.

Type.—American Museum of Natural History.

Food Plants.—*Fagus*, *Platanus*, *Quercus*, *Hamamelis*, *Sassafras*.

Distribution.—So. Que. and So. Ont.; Maine to N.J.

Remarks.—This species lacks the specialized scales that are present on the ventral surface of the second abdominal segment of the male of all other species in the genus. The black scale tufts associated with the genitalia are considerably developed. The locality records show it to have a more southern distribution than the rest of the Canadian species. These characteristics indicate that it may belong to a separate branch of evolutionary development.

***Pandemis pyrusana* Kearfott**

Figs. 98-99

Pandemis pyrusana Kearfott, 1907, Trans. Am. Ent. Soc. 33: 70.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 415.

Pandemis pyraua Meyrick, 1912, Ent. Mon. Mag. 48: 35.

Head, thorax, and fore wing light ruddy-brown. The fore wing with the usual *Pandemis* pattern consisting of a darker basal area, median band, and outer costal spot. The outer edge of the basal area and both sides of the median band narrowly edged with luteous. The outer margin of the basal area scalloped above and below the middle, the lower scallop more deeply concave. Both margins of the median band irregular. This band widest at the dorsal margin, constricted above the cell, and widened at the costa. The wing bearing the usual fine, dark, tortricid reticulations. Fringe concolorous with the apical area. Hind wing pure shining white with concolorous fringe. Abdomen whitish. Expanse: 21-24 mm. Moth in July and August.

Male genitalia.—Typical of the genus. Aedeagus with or without minute teeth ventrally near the apex (Figs. 3, 4).

Female genitalia.—As in *limitata* Robinson.

Type locality.—Alameda Co., California.

Type.—American Museum of Natural History.

Food Plant.—*Cornus stolonifera* Michx.

Distribution.—The dry interior of southern B.C., and Waterton Lakes, Alta., south to California.

Remarks.—This is the only species in the genus with pure white hind wings in both sexes.

***Pandemis limitata* Robinson**

Figs. 96-97

Tortrix limitata Robinson, 1869, Trans. Am. Ent. Soc. 2: 264, Plate 1, Fig. 6.*Pandemis limitata* Robinson, Fernald, 1902, in Dyar, List N. Am. Lep., p. 482.

Meyrick, 1913, Gen. Insect., Fasc. 149: p. 27.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 498.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 569.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 414.

Head, thorax, and fore wing ochereous. Outer margin of basal patch and both margins of median band, narrowly and distinctly bordered with light ochereous. The basal patch, median band, and outer costal spot darker than the ground color and varying from dark ochereous to dark brown. The outer margin of the basal patch crenulate, rarely straight, and the median band constricted below the costa. Fringe of fore wing concolorous with the apical region. Hind wing fuscous behind, white anteriorly and apically, the apex often slightly ochereous and containing a few short dark striae; fringe light, with a dark basal line. This species has the second abdominal segment unusually modified. (Fig. 2B). Expanse: male, 16-20 mm.; female, 20-25 mm. Moth from June to August, most abundant in July.

Male genitalia.—(Fig. 2, 2C) Saccus broad throughout. Coremeta not as large as in *lamprosana* Rob., otherwise similar.

Female genitalia.—(Fig. 60) Antrum long, its ventral edges covered with short bristles. Ductus bursae entirely membranous. Scale tufts present on either side of the plate behind the ostium.

Type locality.—Pennsylvania.

Type.—American Museum of Natural History.

Food plants.—*Betula*, *Alnus*, *Populus*, *Corylus*, *Osmunda*, *Prunus*, *Vaccinium*, *Trifolium*, *Quercus*, *Castanea*, *Pyrus malus* L., *Ulmus*.

Distribution.—N.S., Pa., Ga., west to B.C., Ill. and Ark.

Remarks.—This is a common species, often injurious. It appears to intergrade with *canadana* Kft.

***Pandemis canadana* Kearfott**

Figs. 94-95

Pandemis canadana Kearfott, 1905, Can. Ent. 37: 90.

Meyrick, 1913, Gen. Insect., Fasc. 149: 27.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 499.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 569.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 413.

This name I am retaining tentatively, until more is known of the biology of the species to which the name applies. This form is essentially the same in structure as *limitata* Rob., but is generally darker and may prove to represent a western subspecies. The fore wings usually show a purplish cast and the hind wings are almost entirely fuscous. The time of adult flight coincides with that of *limitata* Rob.

Genitalia.—Similar to those of *limitata*.

Type locality.—Regina, Sask.

Type.—American Museum of Natural History.

Food plants.—Various deciduous plants.

Distribution.—Man. to Alta., Ill., Colo.

ARCHIPPUS nov. gen.

Type species.—*Tortrix packardiana* Fernald.

Archips Hübner, 1822 Syst.—alph. Verz., pp. 58-66 (in part).

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 498 (in part).

Cacoecia Hübner, Meyrick, 1913, Gen. Insect., Fasc. 149: 22 (in part).

Costal fold of male present or absent. Palpus short, slightly upturned or porrect. Dorsal pits present near base of abdomen. Venation as in *Choristoneura* Led.

Male genitalia (Type species *packardianus* Fern., Fig. 11).—Apex of uncus recurved, slightly invaginated, broadly joined to square-shouldered tegumen; arms of gnathos with apices fused; transtilla a simple, twisted band; aedeagus with dentate ventral crest and terminal tooth, and variable number of cornuti (3-8); clasper with ventral margin of base broadly rounded; sacculus broad, but narrower than that of *Archips* Hbn., terminating in a tooth about three-quarters of the distance from the base to the apex of the clasper.

Female genitalia (Type species, Fig. 58).—Ventral plate extended posteriorly to form a truncate median lobe and two rounded, lateral membranous lobes; ostium with well-developed operculum, and short, trough-like antrum in the median line; ductus bursae much shorter than in *Choristoneura* Led., with or without sclerotized ribbon.

This genus includes the following five species: *packardianus* Fernald, *disitanus* Grote, *striatus* Fernald, *alberta* McDunnough, and *oporanus* Linnaeus.

The European species *piceanus* Linn., long considered the type species of *Archips* Hbn. is included and the male and female genitalia (Figs. 6, 53) are figured for comparison.

Key to the Species of *Archippus* nov. gen.

1. Fore wing brownish with black and white longitudinal streaks outlining the veins *striatus* Fern.
- Fore wing with the white and dark areas striated with brownish-grey, giving a
2. Head white; fore wing with pure white bands or mottling 3
- Head and thorax brown or grey; fore wing brownish or light purplish, never with pure white bands or mottling 4

3. Fore wing pure white with black, irregular bands and spots *dissitanus* Grt.
Fore wing with the white and dark areas striated with brownish-grey, giving a mottled appearance *packardianus* Fern.
4. Hind wing whitish with short fuscous striae; fore wing with outer edge of basal patch and inner margin of median band lined with black scales; subapical costal region with short black streaks *alberta* McD.
Hind wing dark fuscous, ocherous apically; fore wing with suffused median band not outlined inwardly with black scaling; subapical costal streaks absent *oporanus* Linn.

***Archippus oporanus* Linnaeus (n. comb.)**

Fig. 102

Phalaena Tortrix oporana Linnaeus, 1758, Syst. Nat. (ed. X) p. 530.

Phalaena podana Scopoli, 1763, Ent. Carn., p. 232.

Costal fold of male present, well developed, smoothly scaled. Dorsal abdominal pits prominent on segments two and three. Head and thorax light rosy-brown. Fore wing brownish-ocherous with a pinkish tint; on the costa, a thin dark-brown line extending obliquely from the basal third to the middle of the posterior wing margin; this representing the inner edge of the median band, which, in the cell, expands into a broad, suffused, reddish-brown blotch; on the costa, apically to this dark line, a pinkish-ocherous spot; basal patch consisting of a dark area of blackish and reddish-brown scales overlaid with white scales at its centre; outer margin of this dark area extending obliquely from the inner edge of the middle of the median band to near the base of the posterior margin, beyond which is a large triangular spot of pinkish-ocherous; outer costal spot pinkish-brown and poorly outlined; below this a large, sub-apical, light ocherous-pinkish blotch, bordered apically by a narrow light-brown band; tip of the wing containing an elongate dark-brown spot; outer margin ocherous-brown; fringe fuscous. Hind wing dark smoky with ocherous apex. Undersurface of fore wing dark fuscous for basal two-thirds, orange-ocherous beyond; of hind wing, fuscous behind and ocherous apically with short dark striae. Expanse 19-26 mm. Moth in June.

Male genitalia (Fig. 7).—Sacculus broad, terminating in a tooth almost at apex of the clasper. Aedeagus large, with seven long cornuti.

Female genitalia (Fig. 54).—Typical of the genus, with well-developed antrum.

Type locality.—Italy?

Type.—?

Food plants.—Coniferous and deciduous trees and shrubs.

Distribution.—Europe, Siberia, Japan, B.C., Ont.

Remarks.—A Holarctic species recorded in Canada from a male taken at light by W. G. Mathers at Vancouver, B.C., June 25, 1937; and from one male and one female reared by R. W. Sheppard, Niagara Falls Laboratory, Plant Protection Division, Canada Department of Agriculture, from larvae feeding on the young shoots of sycamore at a nursery at Font Hill, Ont.

***Archippus strianus* Fernald (n. comb.)**

Fig. 103

Archips strianus Fernald, 1905, Can. Ent. 37: 399.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 497.

Cacoecia striana Fernald, Meyrick, 1913, Gen. Insect., Fasc. 149: 26.

Costal fold of male similar to that of *dissitanus* Grt. Head white. Thorax fawn-coloured. Fore wing with longitudinal white streaks outlining the venation and separated by dark-brown or blackish streaks; the disc showing a light-brownish shade with a slight pinkish cast; the costal region similar, but crossed by the black and white streaks; fringe fuscous. Hind wing uniformly smoky

with whitish fringe. Underside similar to upper side but with disc of the fore wing more fuscous. Expanse: male, female, 20-22 mm. Moth in July.

Male genitalia (Fig. 8).—Tegumen broad, its lateral margins arcuate; aedeagus without ventral dentate crest; cornuti two. Similar to *alberta* McD.

Female genitalia (Fig. 55).—With broad, round ostium and narrow operculum; ductus bursae with sclerotized ribbon in bursal half only.

Type locality.—Quebec.

Type.—United States National Museum.

Food plant.—*Picea*.

Distribution.—N.S. to Alta., Maine, N.H.

Remarks.—This is a beautiful and strikingly marked species, diverging remarkably from the banded type of maculation so characteristic of the subfamily. It is not a common moth and is rare in collections.

***Archippus alberta* McDunnough (n. comb.)**

Fig. 104

Tortrix alberta McDunnough, 1923, Can. Ent. 55: 167.

Costal fold of male long and narrow, with rough, elongate scaling behind. Head light pinkish-ocherous. Thorax pinkish-fuscous. Fore wing pale ocherous with pinkish hue; basal patch marked outwardly by a brown streak, margined outwardly with a fine black line and angled outwardly just below the middle, and somewhat concave in front of the posterior margin of the wing; median band narrowly margined inwardly with black, suffused outwardly with an area of greyish-fawn that joins the outer costal spot and encloses a light costal spot of the pale pinkish-ocherous ground colour; the apical region of the wing shining pale reddish-brown, sharply defined inwardly by a narrow black line not reaching the tornus; another, smaller, light costal spot just before the apex, where there are a few small black spots; the lighter portions of the wing with indistinct, short, dark striae; fringe pinkish-grey. Hind wing whitish with numerous short, dark striae; fringe pale pink. Undersurface of fore wing fuscous with lighter, speckled costa and whitish apical region; of hind wing, similar to upper surface. Expanse: male, female, 24-27 mm. Moth in late July and August.

Male genitalia.—(Fig. 9) Almost indistinguishable from those of *striatus* Fern. The apex of the clasper of *alberta* McD. however, more pointed in the paratype specimen examined.

Female genitalia.—(Fig. 56) Typical of the group, with strong development of the ventral plate into three posterior lobes; ductus bursae entirely membranous.

Type locality.—Nordegg, Alta.

Type.—Canadian National Collection.

Food plant.—*Picea*.

Distribution.—Nfld. to Alta.

Remarks.—This is a strikingly marked, uncommon moth.

***Archippus dissitanus* Grote (n. comb.)**

Fig. 105

Tortrix (Ptycholoma) dissitana Grote, 1879, N. Am. Ent. 1: 29.

Archips dissitana Grote, Fernald, 1902, in Dyar, List N. Am. Lep., p. 481.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 497.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 569.

Cacoecia dissitana Grote, Meyrick, 1913, Gen. Insect., Fasc. 149: 24.

Costal fold of male well developed, long, narrow, and with long scales behind. Head and thorax pure white. Fore wing white with black bands and spots

as follows: the basal patch represented on the costa by a black area from the base of the wing; from the outer margin of basal patch, a thin black band, acutely angled inward at the fold, extending to the hind margin; median band black, its outer margin deeply excavated at the top of the cell and extending irregularly to the posterior margin, where it angles rather sharply inward; between this band and the basal patch, one or two short, black striae on the posterior margin of the wing; outer costal spot often broken to include one or two small white spots; a black, inward-projecting area occupying the apical region of the wing; fringe black, sometimes white in the tornal region. Hind wing uniformly smoky with fuscous fringe with dark basal line. Undersurface of fore wing fuscous, with white posterior and costal margins, the latter with a few, short, black streaks; of hind wing white, fuscous apically. Expanse: male, female, 19-22 mm. Moth in late July.

Male genitalia (Fig. 10).—Clasper pointed apically; sacculus tooth well developed; aedeagus with dentate ventral crest. Very similar to *packardianus* Fern.

Female genitalia (Fig. 57).—Typical of the group. Ductus bursae with sclerotized ribbon along its total length.

Type locality.—Buffalo, N.Y.

Type.—British Museum?

Food plant.—Probably a conifer.

Distribution.—Que., and Ont., Maine to Ohio and N.C.

Remarks.—This is a very striking and pretty moth. It is rare in collections.

***Archippus packardianus* Fernald (n. comb.)**

Fig. 106

Tortrix packardiana Fernald, 1886, U.S.D.A. Bull. 12: 20.

Fernald, 1890, Rept. U.S. Ent. Comm. 5:849.

Meyrick, 1913, Gen. Insect., Fasc. 149: 29.

Forbes, 1923, Cornell Univ. Agr. Sta. Mem. 68: 492.

Costal fold of male absent. Head white or light grey. Thorax grey or greyish-brown, rarely white. Fore wing mottled, the white areas finely speckled with light brown; basal patch usually well defined outwardly with dark grey or black and angled outwardly just below the middle; a grey or blackish median band usually divided in the cell to separate the costal and posterior portions; this band containing indistinct, darker speckles and often narrowly margined with black scales; outer costal spot large and often contiguous with the median band; the region of the tornus containing a dark spot sometimes joined to the median band by a lighter shade; apical region grey, often dotted with white and projecting inward at the middle of the wing; fringe grey, often with white streaks in the tornal region. Hind wing entirely smoky; fringe white with dark basal line. Undersurface of fore wing fuscous, strongly mottled with white spots, especially along the costa; of hind wing, white, lightly speckled with dark-brown streaks. Expanse: male, 15-20 mm.; female, 18-22 mm. Moth in June and early July.

Male genitalia (Fig. 11).—Similar to those of *dissitanus* Grt. but with less acutely pointed clasper; aedeagus with dentate ventral crest.

Female genitalia (Fig. 58).—Similar to those of *dissitanus* Grt. but without sclerotized ribbon in the ductus bursae.

Type locality.—Peaks Island, Casco Bay, Maine.

Type.—United States National Museum.

Food Plants.—*Piceae*, *Abies*.

Distribution.—N.S. to B.C., Maine, N.H., Wyo.

Remarks.—This species was reared from the above type locality by A. S. Packard, who sent the specimens to Fernald for determination. It is common in the Ottawa district.

ARCHIPS Hübner

Archips Hübner, 1822 Syst.-alph. Verz. pp. 58-66.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 493 (in part).

Cacoecia Hübner, 1825, Verz. bekannt. Schmett., p. 388.

Fernald, 1908, The genera of the Tortricidae and their types, p. 14.

Meyrick, 1913, Gen. Insect., Fasc. 149: 26 (in part).

Venation as in *Choristoneura* Led. (Fig. 29). Palpus short, slightly inclined upward, not extending beyond the middle of the frons; third segment short, inclined downward (slightly drooping). Costal fold broadly arcuate or narrow throughout, or absent; extending to inner edge of median band. Abdominal pits present or absent.

Genitalia.—(Figs. 12-21, 61-71; Figs. 12 and 61 of the type species, *xylosteanus* Linn.) Uncus long, spatulate, with narrow neck. Socii absent, or represented by a few hairs on the membrane. Arms of the gnathos long, with fused, upcurved, hook-like apices. Clasper broad; sacculus extending longitudinally along the mid-line, rarely along the ventral margin as in *purpuranus* Clem. (Fig. 21), and terminating in a blunt, upward-projecting tooth at the outer four-fifths; transtilla a simple, hour-glass-shaped band; aedeagus with apex hooked toward the right, or with a minute spine on left side, or simple; cornuti two to six, long and thin; sterigma of female genitalia with a scale tuft on either side; sclerotized ribbon present in ductus bursae, except in *purpuranus* Clem.; antrum well developed, straight or inclined to one side.

Key to Species of *Archips* Hübner

1. Dorsal abdominal pits near the base absent 2
1. Dorsal abdominal pits near the base present 6
2. Hind wing uniformly orange above 3
2. Hind wing not uniformly orange above 4
3. Dark spots on fore wing broad and diffuse *cerasivoranus* Fitch
3. Dark spots on fore wing narrow and distinctly outlined *cerasivoranus rileyanus* Grt.
4. Hind wing fuscous in posterior part and white anteriorly and apically *purpuranus* Clem.
4. Hind wing uniformly dark fuscous or brownish 5
5. Fore wing with ochereous ground, lustrous, and with dark-brown or black spot at the middle of the wing *fervidanus* Clem.
5. Fore wing generally grey or dull brownish, never ochereous *infumatus* Zell.
6. Hind wing uniformly shining white; female with large dark, ventral abdominal scale-brush *negundanus* Dyar
6. Hind wing smoky, at least in posterior half 7
7. Costal fold of male narrow throughout, with tuft of long scales near apex; female with fore wing brown, and hind wing orange apically and dark fuscous basally *rosanus* Linn.
7. Costal fold of male broadly arcuate posteriorly; female with hind wing fuscous apically 8
8. Basal patch of fore wing consisting of three distinct, wavy, transverse reddish-brown lines *georgianus* Wlk.
8. Basal patch indistinct; mottled or diffused 9
9. Median band distinct from the middle of the fore wing to the costa and separated from the outer costal spot by a white or cream-coloured spot; or the whole wing rather uniformly coloured 11
9. Median band not distinct from the middle of the wing to the costa, either completely or almost severed before the costa, or not reaching the costa 10
10. Outer costal spot before the apex broadly extended almost to the tornus *magnolianus* Fern.
10. Outer costal spot not extending to the tornus; a grey species with light-brown, often black-bordered maculation *griseus* Rob.

11. Fore wing almost entirely unicolorous, either reddish-brown or ochereous-fuscous; costa without white or cream maculation some females of *myricanus* McD. 12
Fore wing not unicolorous; paler costal spots present
12. Median band unicolorous, without distinct striations at the posterior margin; female with large abdominal scale-brush; outer costal spot dark, containing a median, distinct, small white spot on the costa; olivaceous-ochereous species *semiferanus* Wlk. 13
Median band not unicolorous at the posterior margin, the latter with irregular markings of fine, dark reticulations; female without ventral abdominal scale-brush
13. Outer costal spot and median band reddish-ochereous, the wing uniformly cream-coloured apically without any other maculation *argyrosipilus columbianus* McD. and *argyrosipilus vividanus* Dyar
Median band and outer costal spots ochereous-olivaceous, reddish-ochereous, dark brown, or dark reddish-brown; apical region of fore wing not uniformly cream-coloured *eleagnanus* McD. and *argyrosipilus* Wlk. complex

Archips infumatanus Zeller

Figs. 107-108

Tortr. (Cacoec.) infumatana Zeller, 1875, Verh. zool-bot. Ges. Wien 25: 216.

Cacoecia infumatana Zeller, Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips infumatana Zeller, Fernald, 1902, in Dyar, List N. Am. Lepid., p. 478.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 496.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 568.

A purplish species with a dark-brown basal patch, a broad median band, and a curved subapical streak, which follows the contour of the outer margin of the wing to the tornus. Apical region light brown. Fringe sordid white. Hind wing uniformly dark brown with light fringe. Undersurface of each wing uniformly dark brown with fringe lighter and costal region of fore wing lighter. Expanse: male, 18-19 mm.; female, 21-25 mm. Moth in June and July.

Male genitalia (Fig. 13).—Uncus rather narrow; aedeagus with subapical tooth on left side, three short cornuti, and ventral crest of short teeth near apical third.

Female genitalia (Fig. 62).—Antrum long; sterigma deep and convex.

Type locality.—Missouri.

Type.—?

Food plant.—*Carya* spp.

Distribution.—N.Y., Conn., Mass., Va., Fla., Tex., La., Ark., Mo., Iowa, Wis.

Remarks.—This is a southern, dark purplish-brown species. It is rare in most collections.

Archips semiferanus Walker

Figs. 109-110

Lophoderus ? semiferanus Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 336.

Cacoecia semiferana Walker, Walsingham, 1879, Ill. Lep. Het. 4: 7, Plate 62, Figs. 2, 3.

Dyar, 1902, Proc. Ent. Soc. Wash. 5: 78.

Dyar, 1903, Proc. U.S.N.M. 25: 401 (larva).

Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips semiferana Walker, Fernald, 1902, in Dyar, List. N. Am. Lepid., p. 480.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 497.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 569.

Tortrix flaccidana Robinson, 1869, Trans. Am. Ent. Soc. 2: 277, Plate 6, Fig. 53.

Tortr. (Loxot.) flaccidana Robinson, Zeller, 1875, Verh. zool-bot. Ges. Wien 25: 219.

Head white or cream-coloured. Thorax and fore wing light olivaceous-brown; median band, the middle of the basal patch and the apical region rusty-brown; usually with a dark patch in the middle of the wing near the base, and a dark, elongate discal spot. Hind wing uniformly light brown,

often with a pinkish cast. Fringe of each wing white. Undersurface of fore wing light ochreous-fuscous on the disc with cream-coloured margin; of hind wing, lustrous whitish. Undersurface of female abdomen with a large brush of closely packed, erect, leaden-purplish, corrugated scales, probably used to cover the eggs. Expanse: male, 19-21 mm.; female 21-26 mm. Moth in late June and early July.

Male genitalia (Fig. 14).—Typical of the group. Aedeagus with subapical tooth and four cornuti.

Female genitalia (Fig. 63).—Sterigma with a narrow ventral plate; antrum trough-like, slightly inclined toward the left.

Type locality.—Unknown.

Type.—British Museum.

Food plants.—*Quercus*, *Hamamelis*, *Pyrus malus* L.

Distribution.—S. W. Ont., Ohio, Pa., N.Y., Mass., N.J., Tex., Ark., Calif., Colo., Wis., Ill.

Remarks.—This is a common species but is restricted to the southern half of the North American continent. Walsingham (1879) associated Walker's name with this North American species.

Archips negundanus Dyar

Figs. 111-112

Cacoecia negundana Dyar, 1902, Proc. Ent. Soc. Wash. 5: 78.

Dyar, 1903, Proc. U.S.N.M. 25: 401 (larva).

Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips negundana Dyar, Fernald, 1902, in Dyar, List N. Am. Lepid. p. 480.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 498.

Similar to *semiferanus* Wlk. Differs in the lighter colour, a more distinct basal patch, median band, and outer costal spot, and with the hind wing pure white with slight ochreous tinge apically. The ventral abdominal tuft of the female without crinkling or corrugation of the scales as in *semiferanus* Wlk.; the scales inclined more toward the apex of the abdomen. In *semiferanus* these scales at right angles to the abdomen. Undersurface lustrous-whitish with slight rusty suffusion on the disc of the fore wing; lighter than that of *semiferanus*. Expanse: Male, 19-21 mm.; female, 22-25 mm. Moth in late June and early July.

Male and female genitalia.—Similar to those of *semiferanus*.

Type locality.—Pike's Peak, Colo.

Type.—United States National Museum.

Food plants.—*Acer negundo* L., *Urtica*, *Lonicera*.

Distribution.—Man., Colo., Minn., Nebr., Wash., Utah, Calif., Tex., Fla., N.J.

Remarks.—This species is often confused with *semiferanus* Wlk., which it closely resembles. The main difference lies in the shape of the scales of the female abdominal venter.

Archips cerasivoranus Fitch

Figs. 113-114

Lozotaenia cerasivorana Fitch, 1856, N.Y. Agr. Rept., p. 382.

Fitch, 1859, Nox. Ins. N.Y., p. 64, Pl. 2, Fig. 3.

Tortrix cerasivorana Fitch, Robinson, 1869, Trans. Am. Ent. Soc. 2: 275, Pl. 6, Fig. 47.

Tortr. (*Cacoec.*) *cerasivorana* Fitch, Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 217.

Cacoecia cerasivorana Fitch, Dyar, 1903, Proc. U.S.N.M. 55: 401 (larva).

Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips cerasivorana Fitch, Fernald, 1902, in Dyar, List N. Am. Lepid. p. 479.

Holland, 1913, Moth Book, p. 422, Plate 48, Fig. 21, female.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 496.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 569.

The only species in the genus with dull reddish-orange head, thorax, and fore wing, the last with violaceous reflections. Hind wing uniformly bright orange. The fore wing crossed with ochereous-brown striations, between which the scales have an iridescent violaceous sheen; median band represented on the costa by a dark purplish or blackish spot; outer costal spot similarly coloured; both of these spots often broken into two dark costal streaks, separated by lustrous purplish scales; middle of the wing often containing some irregular black spots. Fringe of fore wing orange-ochereous; of hind wing, light ochereous. Female less speckled than the male, often almost immaculate. Undersurface uniformly shining ochereous; the male sometimes with disc of fore wing partially fuscous. Expanse: male, 19-21 mm.; female, 21-24 mm. Moth in July.

Male genitalia (Fig. 15).—Typical of the group, similar to those of *fervidanus* Clem.

Female genitalia (Fig. 64).—Ventral plate of sterigma deep, concave; antrum along the horizontal axis.

Type locality.—New York?

Type.—?

Food plants.—*Prunus*, *Salix*, *Fraxinus*.

Distribution.—Que. to B.C., Maine, N.Y., N.J., Mass., Conn., N.H., D.C., Mo., Wash., Oreg., Idaho, Mont., Nev., Calif.

Remarks.—The larvae are social, living in a web covered with frass. This is the ugly-nest caterpillar of the economic literature and often occurs abundantly enough to be of economic importance. It is a common, widely distributed species.

Archips carasivoranus rileyanus Grote

Figs. 115-116

Tortrix rileyana Grote, 1868, Trans. Am. Ent. Soc. 2: 121.

Cacoecia fervidana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 313 (preoccupied).

Tortrix rileyana Grt., Robinson, 1869, Trans. Am. Ent. Soc. 2: 271, Plate 4, Fig. 28.

Riley, 1869, Rep. Ins. Mo. 1: 153, Plate 2, Figs. 4, 5.

Tortr. (Loxot.) rileyana Grt., Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 221.

Archips rileyana Grt., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 479.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 496.

Homona rileyana Grt., Meyrick, 1913, Gen. Insect., Fasc. 149: 19.

Homona rileyana Grote, as syn. of *fervidana* Walker. Barnes & McDunnough, 1917, Check List Lepid. Bor. Am., p. 175.

A subspecies differentiated from typical specimens of *cerasivoranus* Fitch by the uniformly ochereous fore wing, and the small, distinctly outlined, darker spots. The basal patch represented by two or three circular spots, the median band by a costal and a sub-dorsal spot; the outer margin with a row of small spots curving toward the tornus. Similar in size to *cerasivoranus*. Moth in June.

Male and female genitalia.—Similar to those of *cerasivoranus*.

Type locality.—Missouri?

Type.—?

Food plants.—*Carya*, *Symphoricarpos*, *Prunus*, *Juglans*, *Vernonia*, *Aesculus*.

Distribution.—Pa., N.C., Ohio, Miss., Tex., Mo., Wash.

Remarks.—This is a southern subspecies that intergrades in intermediate localities with the typical form. The larvae are social.

Archips fervidanus Clemens

Figs. 130-131

Lozotaenia fervidana Clemens, 1860, Proc. Acad. Nat. Sci. Phila. 12: 347.

Cacoecia fervidana Clemens, Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips fervidana Clemens, Fernald, 1902, in Dyar, List Lepid. N. Am., p. 480.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 496.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 568.

Tortrix paludana Robinson, 1869, Trans. Am. Ent. Soc. 2: 275.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 415.

Head, thorax, and median band in part, ochereous; basal patch shining reddish-brown with a violaceous cast, often ochereous basally, and bordered outwardly with a narrow ochereous band; between the basal patch and the median band, the costal area ochereous or cream-coloured; median band with a shining blackish-blue spot on the costa, and separated from the outer costal spot by a cream-coloured or light ochereous shade; below the outer costal spot a varying amount of shining fuscous, which often extends as a broad vertical band, or is broken up into several streaks or spots, between which the scales are ochereous; in the middle of the wing a dark spot, concolorous with or darker than the dark costal spots, and giving the wing a three-spotted appearance, particularly in the males; this appearance not so evident in the females, in which these three dark areas are not so prominent; a fine, light-brown line extending from the apical edge of the outer costal spot and more or less following the contours of the outer margin to the tornus; beyond this the apical portion of the wing either ochereous or with shining fuscous scales; fringe shining, light ochereous; the whole fore wing very lustrous. Hind wing uniformly smoky, lighter along the costa; fringe light, with fine, dark basal line. Beneath, fore wing shining fuscous, with ochereous costal spots and posterior border; hind wing, shining sordid white, slightly fuscous in posterior half, contrasting with darker fore wing. Expanse: male, 18-21 mm.; female, 21-25 mm. Moth from mid-July to August.

Male genitalia (Fig. 17).—Aedeagus with four cornuti and a subapical lateral tooth.

Female genitalia (Fig. 66).—Ostium broad; antrum extending along the longitudinal axis.

Type locality.—Pennsylvania?

Type.—Academy of Natural Sciences of Philadelphia (*fervidanus* Clem.). American Museum of Natural History (*paludanus* Rob.).

Food plants.—*Quercus*, *Carya*.

Distribution.—Que., Ont., Maine, N.Y., Pa., N.H., N.J., Mass., N.C., Va., Mich., Ill., Wis.

Remarks.—The larvae are partially social, living in small webs covered with frass. This is an extremely variegated species.

Archips argyrosipilus Walker, complex

It is extremely difficult, if not impossible, to assign to the various forms of this group their correct biological status from a purely morphological approach. Their gross anatomy and genitalia appear identical, and the variation of wing pattern of one form often overlaps that of another so that only tendencies of particular maculation are evident. As will be pointed out, there is some evidence that certain forms show geographic representation, but the degree of specificity is obscure. Other forms occur in relatively the same geographical areas with apparently different food plant preferences and are probably specifically distinct.

The group is characterized in the male by the hooked apex of the aedeagus and the presence of two long cornuti (Fig. 16). In the female genitalia (Fig. 65) the bulbous sterigma, and the broad, irregular, inclined, trough-like antrum, distinguish this complex.

In the absence of sufficient biological data of the various entities, these forms are treated as listed in McDunnough's (1939) Check List.

The following key works fairly well for series but may be unreliable for single specimens. The overlapping variation of maculation among the various entities makes it difficult to find key characters.

Key to the *argyropilus* complex

1. Female with slightly recurved costa and acute apex; mainly unicolorous reddish-brown or fuscous. Male usually with median band distinctly outlined, not often reaching the posterior margin; dark outer costal spot usually distinct from the median band; apical portion of wing without darker streak extending from the outer costal spot to the tornus region. Smaller species, 17-20 mm., with striated posterior margin but lacking mottled appearance 2
- Female with costa arcuate, but apex of wing not acutely pointed, never uniformly coloured. Sexes rather similarly marked. Median band indistinctly outlined in the middle of the wing and broken up behind; dark outer costal spot usually joined by a dark band or line to the median band; apical portion of the wing usually with darker streak from or near outer costal spot to tornus area. Posterior margin often with a mottled appearance, or wing ochereous with olivaceous cast. Larger species, 19-24 mm. 3
2. Male usually grey with dark brown or blackish median band and outer costal spot *mortuanus* Kft.
Male reddish with reddish-brown median band and outer costal spot *myricamus* McD.
3. Markings ochereous with a slight olivaceous tint. Described from Manitoba *eleagnamus* McD.
Markings variegated; median band usually reddish-brown, often blackish in western specimens *argyropilus* Wlk.

Archips argyropilus Walker

Figs. 117-118

Retinia argyropila Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 373.

Cacoecia argyropila Wlk., Walsingham, 1873, Ill. Lepid. Het. 4: 8, Plate 62, Figs. 5, 6.

Dyar, 1902, Proc. Ent. Soc. Wash. 5: 78.

Dyar, 1903, Proc. U.S.N.M. 25: 400 (larva).

Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips argyropila Wlk., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 480.

Holland, 1913, Moth Book, p. 422, Plate 49, Fig. 34.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 497.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 569.

Tortrix fuvana Robinson, 1869, Trans. Am. Ent. Soc. 2: 265, Plate 1, Fig. 9.

Tortr. (Loxot.) fuvana Robinson, Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 219.

Tortrix v-signatana Packard, 1870, Rept. Agr. Mass., p. 238.

Wing pattern varying considerably. Head and thorax usually ochereous. The extreme base of the fore wing light ochereous with a few, fine, reddish-brown striations followed by an ochereous, or reddish-brown, or purplish basal patch; between this and the median band, a large, quadrate, white costal spot followed below by ochereous, and mottled with various shades of purplish or reddish-brown; this portion of the wing sometimes cream-coloured, but usually with a very mottled appearance; median band ochereous, reddish-brown, or purplish, and often connected by a spur to a concolorous outer costal spot; sometimes the median band with a mottled appearance; costal region between the outer costal spot and the median band showing as a whitish, subquadrate or triangular spot, which is usually larger and more constant in size and colour than the inner white spot; fore wing either light ochereous apically, with darker ochereous streaks and blotches, or white, with or without striations, and mottled, or rarely, reddish-brown; fringe whitish or light ochereous. Hind wing uniformly fuscous with dirty white fringe. Undersurface of fore wing with

ocherous-fuscos disc and costal spots, as well as with light ocherous costal spots and apical portion; of hind wing dirty white, slightly fuscous in the anal region. Expanse: male, 19-21 mm.; female, 21-24 mm. Moth in late June and early July.

* *Male genitalia*.—(Fig. 16).

Female genitalia.—(Fig. 65).

Type locality.—Georgia.

Type.—British Museum.

Food plants.—*Prunus*, *Rosa*, *Carpinus*, *Cornus*, *Melilotus*, *Viburnum*, *Pyrus*, *Ribes*, *Quercus*, *Vitis*, *Ulmus*, *Platanus*, *Vaccinium*.

Distribution.—N.S. to Vanc. Is., B.C., Maine to Oreg., south to Fla. and Calif.

Remarks.—This species is common wherever it occurs. It sometimes causes considerable damage to apple and rose foliage and is known in the economic literature as the fruit tree leaf roller.

***Archips argyrosipilus vividanus* Dyar**

Figs. 119-120

Cacoecia vividana Dyar, 1902, Proc. Ent. Soc. Wash. 5: 78.

Dyar, 1903, Proc. U.S.N.M. 25: 400 (larva).

Archips argyrosipila vividana Dyar, Fernald, 1902, in Dyar, List Lepid. N. Am., p. 480.

Cacoecia argyrosipila vividana Dyar, Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

It is doubtful if this form has any biological significance. It is apparently an ocherous variant with rather indistinct maculation. There is no difference in structure, size, or time of adult emergence, from the typical form.

Type locality.—Platte Canyon, Colo.

Type.—United States National Museum.

Food plants.—*Rhus*, *Rubus*.

Distribution.—Colo.

***Archips argyrosipilus columbianus* McDunnough**

Fig. 121

Cacoecia columbiana McDunnough, 1923, Can. Ent. 55: 167.

Archips argyrosipila columbiana McD., McDunnough, 1939, Check List Lepid. Can. and U.S.A., Pt. 2, p. 56.

A pale ocherous form with chestnut-red or reddish-brown basal patch, median band, and outer costal spot. Otherwise similar to typical specimens of *argyrosipilus* Wlk. There appears to be little justification for retaining this name. It apparently refers to aberrant females.

Type locality.—Salmon Arm, B.C.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—No records available. Probably a general feeder.

Distribution.—B.C., Utah.

***Archips eleagnanus* McDunnough**

Figs. 124-125

Cacoecia eleagnana McDunnough, 1923, Can. Ent. 55: 166.

Archips eleagnana McD., McDunnough, 1939, Check List Lepid. Can. and U.S.A., Pt. 2, p. 56.

Head light ocherous. Thorax darker. Fore wing light ocherous with white costal spots, and with darker basal patch, median band, and outer costal spot. Similar in colour to *semiferanus* Wlk., but with the posterior margin finely striated with darker ocherous. Resembling lighter specimens of *argyrosipilus*, but lacking a mottled effect. Hind wing uniformly smoky. Underside of fore wing shining whitish with slightly fuscous disc; of hind wing with a narrow fuscous streak along the cubital vein, from base to outer margin, or

fuscous in posterior half. Expanse: male, 20-22 mm.; female, 24-25 mm. Moth in early July.

Type locality.—Aweme, Man.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—*Eleagnus*.

Distribution.—Alta, Man.

Remarks.—The pale ochreous suffusion of the type series is remarkably constant, and since *argyrospilus* also occurs at Aweme, this form can be treated only as a separate species, as at present listed, until biological studies on behaviour are carried out. It is possible that this may represent a sibling species, with a food plant preference for *Eleagnus*. It is slightly larger than *argyrospilus* Wlk.

***Archips mortuanus* Kearfott**

Figs. 122-123

Archips argyrospila mortuana Kearfott, 1907, Can. Ent. 39: 158.

Archips mortuana Kft., Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 497.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 569.

Cacoecia mortuana Kft., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

The male resembling *argyrospilus* Wlk. in structure and in general wing pattern but lacking the mottled effect, and with the ground colour usually a shade of grey with dark reddish-brown or blackish bands, spots, and striae. The white costal region basal of the median band often poorly defined; but the costal region beyond this band very prominently white and more consistently quadrate; rarely, the ground colour reddish-brown or pale ochreous in the middle and apical portions of the fore wing; outer costal spot usually not connected to the median band as in *argyrospilus*, and apical portion of wing usually without curved streak from spot to tornus as in *argyrospilus*.

The fore wing of the female with a more pronounced recurve, resulting in a more acute apex than that of *argyrospilus*. The female usually characterized by a rather uniformly suffused, brownish or dark reddish fore wing, with indistinct darker median band and outer costal spot; or the ground colour light ochreous as in some males as described above. Hind wing of female usually lustrous whitish. Undersurface of fore wing in both sexes smoky with pale cream costal spot; contrasting with the sordid white undersurface of the hind wing, which has a few fuscous striations along the costa. Generally smaller than *argyrospilus*. Expanse: male, 17-19 mm.; female, 19-20 mm. Moth in late June and early July.

Type locality.—New Brighton, Pa.

Type.—American Museum of Natural History.

Food plants.—*Salix bebbiana* Sarg., *Alnus*, *Spiraea*, *Crataegus*, *Cicuta*.

Distribution.—W. Que., E. Ont., Pa., Wis., Calif., Utah, Ill.

Remarks.—This is apparently a small, usually greyish, sibling species, closely allied to *argyrospilus* Wlk., but differing in size, colour of fore wing, and possibly food plant preference.

***Archips myricanus* McDunnough**

Figs. 126-129

Cacoecia myricana McDunnough, 1923, Can. Ent. 55: 167.

Archips myricana McD., McDunnough, 1939, Check List Lepid. Can. and U.S.A., Pt. 2, p. 56.

In wing pattern and size similar to *mortuanus* Kft. and probably conspecific with it. In the male the median band and outer costal spot reddish-brown instead of grey as in *mortuanus*, although some individuals of the latter form have these reddish-brown characteristics. The two intergrade in colour, particularly in Ontario. The costal area beyond the median band silvery-white

as in *mortuanus* Kft. The female resembling *mortuanus*, with recurved costa and acute apex; usually unicolorous reddish-brown, more rarely fuscous, with faint indication of darker median band and outer costal spot; white costal spots usually lacking. Rarely, females marked like the males. Specimens from the Maritime region of Canada uniformly reddish-brown in the males, and perhaps worthy of subspecific status. However, the name *myricanus* McD. applies to the Algonquin Park population, which shows only slight differences in colour from the Ottawa population, or from specimens from New Brighton, Pa., upon which Kearfott based his name *mortuanus*. According to recent practice, the name *myricanus* McD. would fall as a synonym of *mortuanus* Kft., and the more uniformly reddish-brown Maritime population would be described as new. However, until more material is available from other parts of Ontario and from Quebec, the addition of a new name may only complicate the problem. Moth in July (June-August, reared specimens).

Type locality.—Algonquin Park, Ont.

Type.—Canadian National Collection, Ottawa, Canada.

Food plants.—*Myrica*, *Salix bebbiana* Sarg., *Spiraea*.

Distribution.—E. Ont., W. Que., P.E.I., N.S. (mainland and Cape Breton Is.), Tuxedo, N.Y.

Archips rosanus Linnaeus

Figs. 132-133

Phalaena Tortrix rosana Linnaeus, 1758, Syst. Nat. (ed. 10) 1: 530.

Cacoecia rosana Linn., Meyrick, 1913, Gen. Insect., Fasc. 149: 24.

Archips rosana Linn., Fernald, 1902, in Dyar, List Lepid. N. Am., p. 479.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 496.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 568.

Cacoecia bewittana Busck, 1920, Can. Ent. 52: 125.

Archips bewittana Bsk., Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 496.

Head light ochereous. Thorax ochereous to dark brown. Male with fore wing ochereous to dark brown, often with a reddish cast, and finely striated with dark-brown scales; basal patch represented by a short, dark-brown posterior spur as in the male of *griseus* Rob., but shorter; median band normally dark brown, attenuated on the costa and widening on the posterior margin; outer costal spot dark brown, well developed, its outer margin extended to the tornus; costa slightly recurved near the rather acute apex; fringe fuscous. Hind wing smoky with lighter fringe, the latter with dark basal line. Under-surface of fore wing fuscous on disc, ochereous along costa and apical region; hind wing, fuscous on posterior half inwardly, light ochereous or whitish anteriorly and outwardly.

Female similar to male except that basal spur is absent and upper surface of hind wing has orange, often bright orange, apical region. Expanse: male, 17-19 mm.; female, 20-22 mm. Moth in July.

Male genitalia (Fig. 18).—Clasper obtusely pointed apically; aedeagus with cleft apex.

Female genitalia (Fig. 67).—Sterigma in the median line, large and conical; without well-defined antrum.

Type locality.—Europe.

Type.—Whereabouts not determined (Canadian National Collection, *bewittanus* Bsk.).

Food plants.—Apparently a general feeder. *Salix*, *Alnus*, *Syringa*, *Rubus*, *Carya*, *Pyrus*, *Crataegus*, *Quercus*.

Distribution.—N.S. (Cape Breton Is. and mainland) N.B., Ont., Conn., N.Y., B.C., Wash., Oreg., Europe.

Remarks.—This species may have been introduced into the North American continent within comparatively recent times. Its coastal distribution would suggest this. Structurally it differs considerably from the other North American species of the genus. The dorsal abdominal pits are present, but the costal fold is narrow.

***Archips georgianus* Walker**

Figs. 134-135

Retinia georgiana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 372.

Tortrix georgiana Wlk., Grote, 1873, Bull. Buffalo Soc. 1: 15, Plate 1, Fig. 4.

Cacoecia georgiana Wlk., Walsingham, 1879, Ill. Lepid. Het. 4: 9, Plate 62, Fig. 7.

Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips georgiana Wlk., Fernald, 1902, in Dyar, List Lepid. N. Am., p. 480.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 498.

Male.—Head and thorax light ochereous. Fore wing cream-coloured, abundantly spotted and crossed with wavy reddish-brown lines; basal patch consisting of three wavy lines; median band wide, distinctly outlined, constricted in the cell, and abruptly ending before the posterior margin; pretornal spot elongate, reddish-brown; fringe pale ochereous. Hind wing dark orange-fuscous with white fringe. Expanse: 18 mm.

Female.—More speckled in appearance; ground colour leaden in the posterior half, creamy along the costa, and outstanding as a whitish costal spot beyond the median band; basal patch as that of the male, but separated from the broken median band by a leaden streak; median band well defined on the costa and represented below the cell only by two transverse, narrow, reddish-brown, light margined streaks; outer costal spot joined to the posterior margin by a leaden-coloured streak. Hind wing orange-fuscous. Expanse: 21 mm. Moth in July.

Male genitalia (Fig. 19). Uncus long, broadly and evenly rounded apically; cornuti two in number and long; apex of aedeagus bifurcate.

Female genitalia (Fig. 68). Ventral lip of sterigma low and slightly concave.

Type locality.—Georgia.

Type.—British Museum.

Food plants.—Pupae have been found by Dr. E. P. Darlington in rolled leaves of *Quercus* and *Vaccinium* at New Lisbon, N.J.

Distribution.—N.J., Fla., Tex., Wash.

Remarks.—This is a southern species not recorded from Canada. It is a beautiful moth and is not common in collections.

***Archips griseus* Robinson**

Figs. 136-137

Tortrix grisea Robinson, 1869, Trans. Am. Ent. Soc. 2: 268, Plate 4, Fig. 18, female.

Meyrick, 1913, Gen. Insect., Fasc. 149: 34.

Archips grisea Rob., Fernald, 1902, in Dyar, List. N. Am. Lepid., p. 480.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 498.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 569.

Archips brauniana Kearfott, 1907, Trans. Am. Ent. Soc. 33: 69 (n. syn.).

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 413.

Cacoecia brauniana Kft., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Sexually dimorphic in wing pattern, but both male and female with grey head and thorax, and ground colour of fore wings grey.

Male.—Costal fold extending two-fifths of the wing-length. Basal patch represented only by a short dark-brown or blackish spur, extending from near the base of the posterior margin to the middle of the wing at the basal one-

fourth; median band light brown, darker-rimmed anteriorly, extending from the posterior margin to the top of the cell, but not represented on the costa; outer costal spot dark brown, semi-lunate, distinct, with small dark costal spot beyond; apex light grey with brown spot or streak subapically from the middle of the wing to near the tornus; fringe grey. Hind wing uniformly fuscous; fringe whitish, with dark basal line. Undersurface of fore wing mainly fuscous with lighter mid-costal spot; of hind wing dirty white, slightly striated apically. Expanse: 19-19.5 mm.

Female.—Costa recurved, apex acute, basal patch absent; basal half of the wing uniformly light grey with fine, darker striations; median band narrow, blackish or dark brown, interrupted below the top of the cell and obsolete in the posterior half, where it is defined inwardly by light-brown scales; outer costal spot as in male; subapical streak present or absent, light brown, narrow; beyond this a small, dark costal spot as in male. Hind wing and undersurface as in male. Expanse: 24-25 mm. Moth in early July.

Male genitalia (Fig. 20).—Typical of the group. Aedeagus with bifurcate apex and two cornuti.

Female genitalia (Fig. 69).—Antrum deeply trough-like, inclined toward the left; ventral lip lunate, strongly concave.

Type locality.—Ohio.

Type.—?

Food plants.—*Quercus*, *Rudbeckia*, *Carya*, *Pyrus*.

Distribution.—Maine, N.Y., Pa., Ohio, Ill., Mo., Utah, Tex.

Remarks.—This is a southern species, not recorded from Canada.

***Archips magnolianus* Fernald**

Cecocia magnoliana Fernald, 1892, Can. Ent. 24: 121.

Slingerland, 1895, Ent. News 6: 175.

Meyrick, 1913, Gen. Insect., Fasc. 149: 26.

Archips magnoliana Fern., Fernald, 1902, in Dyar, List. N. Am. Lepid. p. 480.

Forbes, 1923, Cornell Univ. Agric. Expt. Sta., Mem. 68: 498.

Leonard, 1928, Cornell Univ. Agric. Expt. Sta., Mem. 101: 569.

Head, thorax, and fore wing fawn, the last with a slight purplish hue and cinnamon-brown markings; markings narrowly margined with white and situated as in *griseus* Rob.; costa strongly reflexed; subterminal streak brown; wing apex of male, pale with dark-brown or blackish scales; fringe light fawn. Some males from Virginia with dark-brown or blackish spots and a pronounced purplish cast. Hind wing fuscous in posterior half, whitish anteriorly; fringe white with dark basal line. Females with more strongly recurved costa and purplish darker markings, as in Virginia males. Undersurface with disc of fore wing slightly fuscous, pale on costa and hind margin; hind wing pale with darker reticulations at apex; female, slightly darker than male. Expanse: male, 21-21.5 mm.; female, 25 mm. Moth in late June and early July.

Male genitalia (Fig. 20A).—Typical of the group. Aedeagus slightly bowed, long, and tapered; with blunt apex and with two very long cornuti.

Female genitalia (Fig. 70).—Sterigma well developed; antrum long, strongly inclined to the left.

Type locality.—Ithaca, N.Y.

Type.—United States National Museum.

Food plant.—*Magnolia acuminata* L.

Distribution.—N.Y., Va.

Remarks.—This species is uncommon in collections.

***Archips purpuranus* Clemens**

Figs. 138-141

Loxotaenia purpurana Clemens, 1865, Proc. Ent. Soc. Phila. 5: 136.*Tortrix purpurana* Clem., Robinson, 1869, Trans. Am. Ent. Soc. 2: 263, Plate 1, Fig. 4.*Tortr. (Cacoec.) purpurana* Clem., Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 215.*Cacoecia purpurana* Clem., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.*Archips purpurana* Clem., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 478.

Holland, 1913, Moth Book, p. 422, Pl. 48, Fig. 30.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 495.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 568.

Tortrix gurgitana Robinson, 1869, Trans. Am. Ent. Soc. 2: 263.*Tortrix lintneriana* Grote, 1873, Trans. Am. Ent. Soc. 4: 424.

Dorsal abdominal pits absent. Costa of male not truly folded although often reflected in part, sometimes for a considerable length, but not as far as the wing base; costa rather strongly recurved in the male and very strongly recurved in the female, more than in any other species in the subfamily; outer costal edge near the apex of the wing concave, giving the apex a lobed appearance. Male with scale tuft dorsally on scape of antenna. Male and female with an erect scale tuft on each side of vertex of head, the tufts inclining toward one another to form a roof-like structure.

Head thorax, and fore wing light to dark-brown; the wing with slight purplish iridescence, more pronounced in the male, and with fine, darker-brown reticulations; disc often purplish-black with indistinct basal patch and median bands, or these patterns distinct and outlined by fine, darker lines; basal patch bent at right angles at the fold; outer costal spot situated at the bottom of the costal concavity, rather indistinct, and usually joined to the tornal region by a fine, dark line; fringe light brown, concolorous with the apical region. Hind wing smoky in the posterior basal half of the anal region, white anteriorly and apically, and with light fringe.

Underside of wings pale, slightly fuscous on disc of fore wing of male; apex of wing often with fine, darker striations. Expanse: male, 20-22 mm.; female, 21-27 mm. Moth occasionally in late June, more commonly throughout July.

Male genitalia (Fig. 21).—Uncus shorter than in any other species of the genus; sacculus narrow along the ventral edge of the clasper; aedeagus long, slightly arcuate, with bevelled apex and seven large cornuti.

Female genitalia (Fig. 71).—Sterigma large and cup-like with a long antrum inclined slightly to right; sclerotized ribbon in basal half of ductus bursae only.

Type locality.—Pa. ? (*purpuranus* Clem.); New York (*lintneranus* Grt.); Pa. (*gurgitanus* Rob.).

Type.—Academy of Natural Sciences of Philadelphia.

Food plants.—*Sassafras*, *Rhus*, *Ribes*, *Vaccinium*, *Rubus*, *Salix*, *Prunus*, *Solidago*, *Viola*, *Geranium*, *Fragaria*.

Distribution.—N.S. to Man., Maine to Fla., Wis., Ill., Tex.

Remarks.—The strongly recurved costa is a good character for the identification of this species.

CHORISTONEURA* LedererChoristoneura* Lederer, 1859, Wien, Ent. Monatschr. 3: 242.*Cacoecia* Hbn., Meyrick, 1913, Gen. Insect., Fasc. 149: 22 (in part).*Archips* Hbn., Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 493 (in part).*Harmologa* Meyrick, 1913, Gen. Insect., Fasc. 149: 41 (in part).

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 489.

Dorsal abdominal pits absent. Costal fold of male present or absent. Wing venation typical of the subfamily (Fig. 29).

Male genitalia (Fig. 27).—Base of the uncus constricted to join the tegumen narrowly in the median line; socii present, usually well developed and arising from a lateral piece which may be the socius base, and which joins the uncus ventrally and extends to the base of the gnathos arm; succulus extending along the ventral margin, subequal to the length of the clasper; cornuti three to seven, long and lanceolate; aedeagus rather straight, with ventral apical tooth, or subapical lateral tooth, or bifurcate apical teeth.

Female genitalia (Fig. 28).—Sterigma usually long and narrow, lacking an operculum so that the ostium is ventrally open to view; trough-like antrum inclined to the left and inward so that the dorsal and sometimes the ventral surface of the trough may be seen through the ostium (Fig. 74, *lambertiana*); ductus bursae extremely long, with sclerotized ribbon from near the antrum to the bursa.

Key to the species of *Choristoneura* Led.

1. Inner margin of median band well defined and straight, sometimes arcuate near the hind margin; or fore wing lustrous and ocherous, rarely violaceous, with median band obsolete but appearing straight along the inner edge. Costal fold of male sometimes present 9
 - Median band very irregular along its inner margin, or this area not defined as a band. Costal fold of male always absent 2
2. Apical third of fore wing pure white. Hind wing ocherous *carmana* B. & Bsk.
 - Apical third of fore wing never pure white. Hind wing white, at least in part, or fuscous 3
3. Fore wing grey or greyish-brown 8
 - Fore wing ocherous or reddish 4
4. Hind wing entirely fuscous 5
 - Hind wing white or faintly fuscous behind 7
5. Fore wing with a mottled appearance, the bands and spots narrowly edged with whitish borders *retiniana* Wlshm.
 - Bands and spots not edged with whitish 6
6. Fore wing reddish, usually with distinct pattern, with rather strong contrast between the reddish and the paler markings; and with silvery-white costal spot *pimus* Free.
 - Fore wing more ocherous, with more suffused, indistinct maculation reddish forms of *fumiferana* Clem.
7. Fore wing with numerous, wavy, narrow, blackish lines traversing the wing and outlining the somewhat obscure brownish-ocherous maculation *boustonana* Grt.
 - Fore wing without blackish wavy lines traversing the wing. Median band obscure and irregular. A reddish-ocherous species *lambertiana* Bsk.
8. Fore wing uniformly bicoloured, with dark-grey basal, median, and apical region and with light-grey ground colour marked with short, darker striae. A large species, 26-33 mm. in expanse *conflictana* Wlk.
 - Fore wing mottled; usually with a dark blotch in the cell and with a white costal spot; bands very indistinct, broken; darker striae usually black. A smaller species, 21-30 mm. in expanse *fumiferana* Clem.
9. Hind wing pure white, sometimes slightly ocherous at extreme apex *albaniana* Wlk.
 - Hind wing dark fuscous, sometimes light fuscous in the region of the anal veins 10
10. Median band throughout, dark brown; outer costal spot similarly coloured; costa very lightly coloured between the median band and the outer costal spot. Hind wing of male uniformly dark fuscous. Hind wing of female fuscous with yellowish apical region *fractivittana* Clem.
 - Median band narrower, lighter in colour; costa not outstandingly light-coloured between the median band and the outer costal spot. Hind wing of male light fuscous, particularly in the anal region. Hind wing of female fuscous, or mainly orange 11
11. Male with costal fold and tufted antennal scape. Female with anterior and apical parts of hind wing orange *rosaceana* Harr.
 - Male without costal fold and without tufted antennal scape. Female hind wing not orange apically 12

12. Median band distinct from the costa to the posterior margin, sometimes broken in the region of the cell 14
 Median band not distinct, but suffused, or appearing only as a distinct costal spot; more rarely also a similar spot near the middle of the wing near the hind margin 13
13. Maculation vaguely differentiated. Occurring in the Maritime region of Canada and northeastern United States *obsoletana* Wlk.
 Costal spots distinct. A smaller species with evenly curved costa. Occurring in Florida and Georgia *seminolana* Kft.
14. Middle of outer costal spot distinctly continued as a fairly straight, oblique line to the tornus. Fore wing somewhat lustrous but not with satin-like gloss.
 Ventral margin of sacculus produced into a blunt tooth; aedeaus without large teeth beyond sheath *parallela* Rob.
 Middle of outer costal spot not distinctly continued as a straight line to the tornus. Fore wing with satin-like gloss. Median band obscure in the upper portion of the discal cell. Aedeagus with large teeth on the left side beyond the sheath; ventral margin of sacculus not produced into a blunt tooth *zapulata* Rob.

Choristoneura pinus Freeman

Figs. 149-151

Archips fumiferana, Graham, 1929, Papers Michigan Acad. Sci. Arts and Letters 9 (1928): 517-523 (in part).

Graham, 1929, Principles Forest Entomology, p. 147, McGraw-Hill Book Company, New York (in part).

Graham, 1935, Univ. Michigan School Forestry Bulletin 6 (in part).

Graham, 1939, Principles Forest Entomology, p. 174, McGraw-Hill Book Company, New York (in part).

Brown and MacKay, 1943, Can. Ent. 75: 207 (in part).

Freeman, 1946, Ann. Rept. Ent. Soc. Ontario, p. 8 (in part).

Choristoneura pinus Freeman, 1953, Can. Ent. 85: 122.

MacKay, 1953, Can. Ent. 85: 128 (larva).

Campbell, 1953, Can. Ent. 85: 134 (pupa).

Cox, 1953, Can. Ent. 85: 136.

Smith, 1953, Can. Ent. 85: 141.

Male.—Head ochereous-tawny. Palpus concolorous, with the apical segment fuscous. Thorax and fore wing ochereous-tawny, the later with distinct maculation consisting of ochereous-tawny basal patch, median band, and outer streak, separated from each other by silvery or ochereous-white areas and sprinkled with short, transverse striae of darker scales; basal patch well defined outwardly, extending from the basal fourth of the costa to just beyond the middle of the hind margin, indented below the cell and extending along the hind margin to a point in line with the costal portion; median band constricted in the cell by a concavity of the inner margin, extending rather broadly and irregularly to the posterior margin, its outer margin reaching the tornus; apically from the median band, a silvery-white, quadrate costal spot finely connected to a silvery, irregular area, that extends to the tornus; beyond, toward the apex, a large, dark costal spot is more or less connected to a concolorous ovate spot below; apical region concolorous with the light areas of the wing and containing a subapical series of darker dots; the lighter area between the basal patch and the median band tending to whitish on the posterior margin; costa containing two or three fine, white subapical streaks; fringe shining fuscous. Hind wing entirely dark smoky with a white fringe marked by a dark basal line. Under-surfaces of all wings fuscous; that of the fore wing lighter on the costa with the white costal spot repeated below and with darker costal streaks; hind wing beneath, lighter along the costa and with ochereous-tawny apical spots.

Female.—Similar to the male but often with the lighter bands more silvery-white.

Expanse.—Male, 18-23 mm.; female, 15-24 mm. Moth in July, flying approximately two weeks later than *fumiferana* Clem.

The maculation of *C. pinus* is rather uniform as compared with that of *fumiferana*. In a few specimens the ocher colour predominates the fore wings, the specimens are darker, and the maculation less distinctive. The hind wings of most of the specimens are dark fuscous but approximately one specimen in 150 has one hind wing considerably lighter. In general, the smaller size, the ocherous-tawny ground colour and the silvery-white costal spot distinguish *pinus* from *fumiferana*.

Male genitalia (Fig. 26).—Typical of the genus. Clasper broad with narrow sacculus heavily sclerotized, folded and terminating in a blunt tooth at outer third; aedeagus broad, with ventral terminal tooth and four deciduous cornuti; socii well developed, pendulous; transtilla a simple broad band; uncus with apex spatulate or narrowly spoon-shaped, apex narrower than that of *fumiferana*.

Female genitalia.—Typical of the genus. Ductus bursae extremely long, with a thin, longitudinal sclerotized band extending from the neck of the bursa to near the sterigma; antrum inclined; dorsal sterigmal plate narrow; signum in bursa shaped like a curved horn with a bulbous base.

Type locality.—Beausejour, Man.

Type.—Canadian National Collection.

Food plants.—*Pinus* spp., especially *banksiana* Lamb. and *resinosa* Ait. Rarely *Picea* spp.

Distribution.—N.S., Ont., Man., Mich. It seems probable that the complete distributional pattern of *pinus* is unknown. No material has been seen from jack-pine areas west of Manitoba and north of the prairie region. I have seen material only from Nova Scotia, Ontario, and Manitoba. Throughout most of its known distributional range, it is sympatric with *fumiferana*, flying about two weeks later.

Remarks.—This species is easily distinguished by the ocherous-tawny colour and the distinct banding of the fore wing. It is remarkably uniform in colour and size, being generally smaller than *fumiferana* Clem.

***Choristoneura fumiferana* Clemens**

Figs. 145-147

Tortrix ? *fumiferana* Clemens, 1865, Proc. Ent. Soc. Phila. 5: 139.

Tortrix nigridia Robinson, 1869, Trans. Am. Ent. Soc. 2: 268, Plate 4, Fig. 20, male.

Tortrix fumiferana Clem., Packard, 1890, Fifth Rept. U.S. Ent. Comm., p. 830.

Fernald, 1902, in Dyar, List. N. Am. Lepid., p. 483.

The Spruce-bud *Tortrix*, Packard, 1884, Am. Nat. 18: 424.

Harmologa fumiferana Clem., Meyrick, 1913, Gen. Insect., Fasc. 149: 41.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 489.

Archips fumiferana Clem., Graham, 1929, Papers Michigan Acad. Sci. Arts and Letters, 9 (1928): 517-523 (in part).

Graham, 1929, Principles Forest Entomology, p. 147. McGraw-Hill Book Company, New York (in part).

Graham, 1935, Univ. Michigan School Forestry Bulletin 6 (in part).

Graham, 1939, Principles Forest Entomology, p. 174, McGraw-Hill Book Company, New York (in part).

Brown and MacKay, 1943, Can. Ent. 75: 207 (in part).

Freeman, 1946, Ann. Rept. Ent. Soc. Ontario, 1945, p. 8.

Cacoecia fumiferana Clem., Atwood, 1944, Can. Ent. 75: 64.

Choristoneura fumiferana Clem., Freeman, 1947, Can. Ent. 79: 21.

Freeman, 1948, Ent. News 59: 202.

Freeman, 1949, Can. Ent. 81: 10.

Freeman, 1953, Can. Ent. 85: 121.

- MacKay, 1953, Can. Ent. 85: 128 (larva).
 Campbell, 1953, Can. Ent. 85: 134. (pupa).
 Cox, 1953, Can. Ent. 85: 136.
 Smith, 1953, Can. Ent. 85: 141.

Maculation extremely variable. Fore wing mottled; with suffused, indistinct bands rather than the usual basal patch, median band, and outer costal spot; rarely in some individuals the median band quite well defined. Head and thorax usually grey, sometimes reddish-brown. Fore wing usually grey with suffused, indistinct darker markings and short striae; rarely some males and more commonly the females with a reddish cast approaching the colour of *pinus* but lacking the distinct maculation of the latter; basal patch indistinct, usually represented by a few faint, blackish striae; area of the median band, as a rule, more uniformly coloured than the rest of the wing and the median band usually distinct only on the costa; *middle of the wing, as a rule, containing a blackish spot or bar, above which is a whitish costal spot*; beyond the middle of the wing, a greyish sometimes whitish area, often with the veins outlined with darker scales; region of the outer costal spot more or less connected to the tornus by a dark streak; apical region of the wing lighter and with a few dark speckles; fringe shining, light fuscous. Hind wing uniformly dark fuscous with whitish fringe containing a dark basal line. Undersurface of all wings shining fuscous, the fore wing darker, with light and dark costal spots; the hind wing light fuscous with lighter apex containing a few dark spots. Expanse: males 21-26 mm.; females 22-30 mm. Moth in late June and early July, flying approximately two weeks earlier than *pinus*.

Throughout the range there is a large amount of intra-specific variation in maculation and pigmentation. The variation in the amount of red colouring, that replaces the fuscous, is more commonly associated with the females and gradually increases in frequency from east to west. It may be considered as a partially sex-associated character with an east-west clinal frequency.

Male genitalia.—(Fig. 27) Uncus constricted before apex; wider at apex than in *pinus*, varying from 155.3 to 252.72 microns. Otherwise similar to that of *pinus*.

Female genitalia.—(Fig. 28). Similar to those of *pinus*.

Type locality.—Virginia.

Type.—Academy of Natural Sciences Philadelphia.

Food plants.—*Picea* and *Abies*, more rarely *Larix* and *Pinus*.

Distribution.—Essentially a moth of the boreal forest. From Virginia northward to Labrador, westward across Canada and the northern United States to British Columbia, southward in the Cordilleran region to Arizona and California, and northward to the Yukon.

Remarks.—In south-central British Columbia and southward to California and New Mexico, the populations are extremely variable in maculation. The general colour of the fore wing tends more to reddish, particularly in the female. The reddish colour approaches and, in some cases, matches exactly the colour of the eastern jack-pine species; it also grades into a dark-grey that is indistinguishable from the colour of eastern specimens of *fumiferana*. In the east, reddish females of *fumiferana* are not common, and reddish males are extremely rare. Confusion has arisen regarding the relationship of *pinus* and *fumiferana* because western specimens possess colour characters of both, and bridge the gap of colour discontinuity. The two eastern forms, however, are distinct species. The status of the western forms is not clear.

In certain areas, *pinus* and *fumiferana* occur together, but there is no evidence that they hybridize in nature. It has been shown by Smith that, if one sex of one species is caged with the opposite sex of the other species, they will mate and usually produce healthy offspring. It must be remembered, however, that the caging of certain insects often influences their natural mating behaviour patterns, and they often behave in a manner different from that exhibited in nature. There is no evidence that these two species hybridize in nature. The jack-pine species usually flies approximately two weeks later than *fumiferana* in any one locality. There is also a difference in oviposition habits: the eggs of *pinus* are laid in a longer row along the length of the needle than those of *fumiferana* regardless of the length of the needle.

There is also a difference in the width of the subapical portion of the uncus of the male genitalia. Along with this genitalic difference, there is a rather striking difference in pigmentation and maculation. *C. fumiferana* is usually grey with indistinct maculation, or occasionally dull reddish-brown in the female and rarely so in the male. Intermediates occur within the colour range. The jack-pine species, on the other hand, is bright brick-red with distinct maculation and it is remarkably uniform in colour. In New Jersey, Massachusetts and Nova Scotia, an unusual, dark-lined form occurs (Fig. 153) but it is not sufficiently well known to establish its relationship to the other forms.

Western forms of *Choristoneura fumiferana* complex

Figs. 148, 152, 155-157

As previously mentioned, the biological status of the various forms that appear to occur from British Columbia to California is not established. The variation of wing maculation and colour is exceedingly great, and some individuals are almost undistinguishable from the reddish individuals of *pinus*, whereas others resemble grey variants of eastern *fumiferana*. Intermediates in colour occur which appear to bridge the colour gap between *pinus* and *fumiferana*. The width of the subapical portion of the uncus lies almost exactly between the modes for the two eastern species. Any one or a combination of the following speculations regarding the specificity of these populations may be correct. They may represent one or more distinct, highly variable species, indigenous to the mountainous regions of western United States and Canada, or they may be cordilleran subspecies of either or both of the eastern species. Finally, they may represent natural hybrids between the two eastern species. In the east, adults of *pinus* emerge about two weeks later than those of *fumiferana*. In the mountains, spruce occurs at a higher altitude than pine or Douglas fir. The difference in altitude may retard the spruce-feeding individuals so that they emerge coincidentally with the normally later-emerging pine-feeding form. If this temporal isolating factor is decisive in maintaining the identity of the two eastern species, it is conceivable that in the west this isolation breaks down because of the difference in altitude, and the two forms have ample opportunity to hybridize. This is entirely speculative. The intermediate width of the uncus, and the extreme variability of maculation and wing colour, lend support to the supposition of the occurrence of such natural hybrids. The extreme variations of colour and wing pattern may represent a recent scattering of the genetic variability, that is in part expressed by colour, and not yet stabilized. The possibility of local geographic isolation of small populations by mountain barriers also favours variability by genic interchange between those local populations. Many transcontinental species of insects tend to become much more variable in the western, mountainous regions of North America and such local barriers are no doubt responsible.

An unusual form occurs in Colorado and in California (Figs. 155-157). The general colour of the fore wing is light ochereous with suffused darker-ochereous spots. Anatomically it is allied to the western complex, but its relationship to the other forms is not established. The small amount of material examined is remarkably constant in wing colour and it may represent a distinct species.

***Choristoneura lambertiana* Busck (n. comb.)**

Fig. 158

Tortrix (*Cacoecia*) *lambertiana* Busck, 1915, Proc. Ent. Soc. Wash. 17: 86.

Archips lambertiana Bsk., McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 56.

Cacoecia fumiiferana lambertiana Bsk., Balch, 1930, Forest Worker, U.S.D.A. For. Sev. Bi-Mon., p. 14.

Head light ochereous. Thorax ochereous-tawny. Fore wing light ochereous with darker ochereous-tawny markings and with essentially the same pattern as *pinus* but with the dark bands and spots, as well as the lighter ground colour between them, lighter and more ochereous than tawny; the light ground colour of the same shade throughout the wing; the costal region beyond the median band, light ochereous instead of white as in *pinus*; fringe shining light ochereous. Hind wings white with slightly ochereous apex. Undersurface of each wing shining whitish. Expanse: male, 23 mm.; female, 22 mm. Moth in July.

Male and female genitalia (Figs. 31, 74).—Similar to those of *pinus* but the male with uncus more constricted at the middle.

Type locality.—Oakland, Oregon.

Type.—United States National Museum.

Food plants.—*Pinus lambertiana* Dougl., *Juniperus*.

Distribution.—Oreg., Calif., N. Mex.

Remarks.—Superficially, this species is closely allied to *pinus* but is readily distinguished by the white hind wings and the narrower neck of the uncus.

***Choristoneura carnana* Barnes & Busck (n. comb.)**

Fig. 154

Tortrix carnana Barnes & Busck, 1920, Contr. Nat. Hist. Lepid. N. Am. 4: 214, Plate 28, Fig. 1.

Archips carnana B. & Bsk., McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 56.

Head and thorax bright reddish-brown, the latter with white-margined tegulae. Fore wing white, with bright ferruginous basal patch and concolorous, broad, irregular median band, the latter not quite reaching the posterior margin; the rest of the wing and the fringe pure shining white. Hind wing dull ochereous, white along the costa and with shining white fringe. Undersurface of fore wing ochereous on the disc with whitish discal spot, costal spots and margins; hind wing white, ochereous along the costa. Expanse: male, 25 mm. Moth in late June.

Male genitalia (Fig. 30).—Similar to those of *lambertiana* Bsk., with perhaps narrower uncus (not enough material to be certain).

Type locality.—Camp Baldy, San Bernardino Mts., California.

Type.—United States National Museum.

Food plant.—Unknown.

Distribution.—Calif.

Remarks.—This is a very strikingly marked insect, closely allied to the *fumiiferana* Clem. complex.

***Choristoneura retiniana* Walsingham (n. comb.)**

Fig. 159

Lozotaenia retiniana Walsingham 1879, Ill. Lepid. Het. 4: 12, Plate 63, Fig. 3.

Archips retiniana Wlsh., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 481.

Cacoecia retiniana Wlsh., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Head, thorax, and fore wing ochereous-tawny as in *pinus*. The wing pattern in general similar to that of the latter species but the darker bands and spots more irregular and narrowly outlined with whitish scales, giving the wing a speckled or mottled appearance. Fringe, hind wing, and under-surface similar to those of *pinus*. Expanse: 20-23 mm. Moth in July and August.

Male genitalia (Fig. 33).—Typical of the group but with narrower uncus and shorter, narrow sacculus terminating in a sharp spine.

Female genitalia.—Similar to those of *fumiferana* Clem.

Type locality.—Mount Shasta, California.

Type.—British Museum.

Food plant.—Unknown.

Distribution.—Calif.

Remarks.—This species superficially resembles *pinus* but differs in maculation and in male genitalia.

***Choristoneura conflictana* Walker (n. comb.)**

Figs. 143-144

Tortrix conflictana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 323.

Heterognomon conflictanus Wlk., Walsingham, 1879, Ill. Lepid. Het. 4: 10, Pl. 62, Fig. 9.

Cacoecia conflictana Wlk., Meyrick, 1913, Gen. Insect., Fasc. 149: 26.

Archips conflictana Wlk., Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 494.

Costal fold of male absent. Head, thorax, and fore wing light grey; the wing with brownish-grey basal patch and median band distinct or faintly indicated; short, dark striae usually diffuse; outer costal spot and curved subterminal shade poorly outlined; fringe very shining light grey. Hind wing entirely brownish-fuscous with whitish fringe with dark basal line. Undersurface shining, uniformly brownish-ocherous, sometimes with darker costal spots. Expanse: male, 22-29 mm.; female, 28-35 mm. This is the largest North American species in the subfamily. Moth in June and early July.

Male genitalia (Fig. 34).—Uncus short, slightly constricted at middle; tegumen broad; transtilla twisted; clasper very broad; sacculus simple, slightly lobed ventrally near its apex; socii erect; aedeagus with minute dorsal spines.

Female genitalia (Fig. 76).—Typical of the group. Sterigma wide; antrum short.

Type locality.—St. Martin's Falls, Albany River, Ont.

Type.—British Museum.

Food plant.—*Populus*.

Distribution.—Labr. to Alaska, Pa., Mass., N.J., N.H., Ohio, Wis., Colo., Utah, Mont.

Remarks.—This is a widely distributed, common species, known in the economic literature as the large aspen tortrix.

***Choristoneura fractivittana* Clemens**

Figs. 162-163

Lozotaenia fractivittana Clemens, 1865, Proc. Ent. Soc. Phila. 5: 136.

Tortrix fractivittana Clem., Robinson, 1869, Trans. Am. Ent. Soc. 2: 265, Pl. 1, Fig. 10, male.

Meyrick, 1913, Gen. Insect., Fasc. 149: 30.

Archips fractivittana Clem., Fernald 1902, in Dyar, List. N. Am. Lepid., p. 480.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 495.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta. Mem. 101: 568.

Tortrix fumosa Robinson, 1869, Trans. Am. Ent. Soc. 2: 268, Pl. 4, Fig. 19, female.

Head and thorax ochereous. Fore wing similarly coloured; median band and outer costal spot dark brown, the former very broad throughout, basal patch indistinct; between the median band and the outer costal spot, the costa outstandingly light ochereous; the lighter areas of the wing containing a few

indistinct, short, darker striae. Costal fold of male absent. Fringe light ochereous. Hind wing of male entirely dark fuscous; fringe sordid white with dark basal line. Hind wing of female dark fuscous posteriorly, yellowish anteriorly and apically. Expanse: male, 18-22 mm., female, 24-28 mm. Moth in June.

Male genitalia (Fig. 35).—Uncus broad; sacculus broad throughout to the outer margin of the clasper; aedeagus with minute dorsal spines and numerous cornuti.

Female genitalia (Fig. 73).—Plate behind ostium broad, with lateral scale tufts. Otherwise, typical of the genus.

Type locality.—Virginia.

Type.—Academy of Natural Sciences of Philadelphia.

Food plants.—*Fagus*, *Pyrus*, *Rubus*, *Quercus*.

Distribution.—Que. to Alta., Pa., Mass., N.Y., Ohio, Wis., Colo., Mont.

Remarks.—This is a common species, and is sometimes confused with *rosaceana* Harr. and *parallela* Rob.

***Choristoneura houstonana* Grote (n. comb.)**

Fig. 164

Tortrix houstonana Grote, 1873, Bull. Buffalo Soc. 1: 15, Pl. 1, Fig. 5.

Lozotaenia retana Walsingham, 1879, Ill. Lepid. Het. 4: 13, Plate 63, Fig. 4.

Cacoecia houstonana Grt., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Archips houstonana Grt., McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 56.

Costal fold of male absent. Vertex and tegulae light ochereous. Face and thorax ochereous. Fore wing light ochereous, crossed by irregular, narrow, darker (ochereous-brown) bands which show a pinkish tint and are margined by black, distinct, fine lines; basal patch consisting of two contiguous bands and connected to the irregular median band in the middle of the wing by a thin black line; outer edge of the median band with a black dot; fringe light ochereous. Hind wing light fuscous behind, whitish apically and anteriorly; fringe shining whitish. Undersurface shining whitish; disc of the fore wing light fuscous; costa of the fore wing with short dark streaks. Expanse: 19 mm. Moth in August.

Male genitalia (Fig. 36).—Uncus extremely broad; socii small, with basal plates well differentiated; gnathos arms goblet-like in outline, the apices fused for some length; transtilla folded in the median line; clasper short, thick; sacculus extending narrowly along the ventral margin of the clasper; aedeagus tubular, rather straight, without ventral apical tooth.

Female genitalia (Fig. 77).—Aberrant; the ninth tergite hood-like.

Type locality.—Texas.

Type.—British Museum.

Food plant.—"Cedar".

Distribution.—Texas, Arizona.

Remarks.—This species was described from two males and one female.

***Choristoneura albaniana* Walker (n. comb.)**

Figs. 160-161

Teras albaniana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 288.

Pandemis albaniana Wlk., Walsingham, 1879, Ill. Lepid. Het. 4: 11.

Tortrix arctica Moeschler, 1874, Stett. Ent. Zeit. 35: 164.

Archips arctica Moesch. Fernald, 1902, in Dyar, List. N. Am. Lepid., p. 478 (as syn. of *rosaceana* Harr.).

McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 56.

Cacoecia arctica Moesch, Meyrick, 1913, Gen. Insect., Fasc. 149: 26 (as syn. of *rosaceana* Harr.).

Tortrix kukakana Kearfott, 1907, Trans. Am. Ent. Soc. 33: 70.

Meyrick, 1913, Gen. Insect., Fasc. 149: 30.

Archips kukakana Kft., McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2. p. 57 (as syn. of *arcticana* Moesch.).

Costal fold of male absent. Head light ochereous. Thorax reddish-ochereous to greyish-ochereous. Fore wing light ochereous with fine dark striae and contrasting reddish-brown median band, outer costal spot, and subapical portion of the wing. Specimens from more northern localities grey with less contrasting, greyish-brown median band and subapical region. Basal patch obsolete, sometimes slightly darker and vaguely outlined by a fine, dark-brown line; median band slightly constricted below the costa and widening somewhat to the posterior margin; its inner margin nearly straight, slightly concave in the region of the fold; the outer or apical margin less distinct, suffused with the ground colour beyond; outer costal spot vaguely defined, its inner margin continued to the tornus by a sharply defined, often convex, dark-brown line that margins the darker, subapical region of the wing; extreme apex often with a round light spot; fringe shining, dark brown or blackish. Hind wing pure white in specimens from more southern localities; fuscous behind with obscure, short, dark striae in specimens from more northern localities; fringe white. Undersurface of fore wing fuscous, lighter along the costa and apically with short, dark striae; of hind wing white with costal and apical, short, dark striae. Expanse: 21-22 mm. Moth from late June to August, depending on the latitude.

Male genitalia (Fig. 32).—Characterized mainly by the short, stubby uncus and pointed sacculus, which extends slightly beyond the apex of the clasper.

Female genitalia (Fig. 75).—Typical of the group and with short antrum.

Type locality.—St. Martin's Falls, Albany River, Ont.; Labrador (*arcticana* Moesch.); Kukak Bay, Alaska (*kukakana* Kft.).

Type.—British Museum (*albaniana* Wlk.); Collection Staudinger ? (*arcticana* Moesch.); United States National Museum (*kukakana* Kft.).

Food plant.—Unknown.

Distribution.—Labr. to Alaska; Gaspé, Que.; Smoky Falls, North Ont.; Churchill, Man.; Great Bear Lake, N.W.T.; B.C.; Maine; N.H.

Remarks.—This is a northern species; it is sometimes confused with *rosaceana* Harr., but is readily distinguished by the genitalia and by lack of the male costal fold. I am indebted to the officers of the British Museum whose help enabled me to associate the correct species with Walker's name.

Choristoneura rosaceana Harris (n. comb.)

Figs. 167-168

Loxotaenia rosaceana Harris, 1841, Inj. Ins., 1st ed., p. 348.

Fitch, 1859, Rept. Ins. N.Y. 3: 28.

Clemens, 1860, Proc. Acad. Nat. Sci. Phila., p. 347.

Harris, 1862, Inj. Ins., 3rd ed., p. 481.

Packard, 1869, Guide Stud. Ins., p. 335.

Teras vicariana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 287.

Tortrix rosaceana Harr., Robinson, 1869, Trans. Am. Ent. Soc. 2: 262.

Tortrix gossypiana Packard, 1869, Guide Stud. Ins., p. 335.

Tortrix (*Cacoec.*) *rosaceana* Harr., Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 215.

Cacoecia rosaceana Harr., Dyar, 1903, Proc. U.S.N.M. 25: 401 (larva).

Meyrick 1913, Gen Insect., Fasc. 149: 26.

Archips rosaceana Harr., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 478.

Holland, 1913, Moth Book, p. 422, Pl. 48, Fig. 32, female.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 496.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 568.

A light reddish-brown species with distinct, dark-brown reticulations and outer costal spot. Inner margin of median band distinct for the entire length,

the outer margin indistinct in the cell. Hind wing of female bright orange apically. Male with costal fold from the base of the fore wing to the inner edge of the median band; the fold produced into an oval, blackish scale-tuft at its middle. Male with well-developed scale-tuft on upper side of scape of antennae. Undersurface of male fore wing with obsolete maculation of upper surface but without fuscous shading in the cubital region, and with small, dark costal and apical striations on the hind wing; undersurface of female uniformly shining yellowish, particularly on the fore wing and apically on the hind wing. Expanse: male, 19-23 mm.; female, 25-30 mm. Moth in the Ottawa district common in early June, less so again in August; elsewhere, May to September.

Male genitalia (Fig. 41).—Uncus very broad apically; aedeagus with very minute spines apically; sacculus extending narrowly along the ventral margin of the clasper.

Female genitalia (Fig. 78).—Typical of the group, with narrow sterigma, short, trough-like antrum, and with sclerotized ribbon throughout the length of the ductus bursae.

Type locality.—Massachusetts.

Type.—? Probably lost.

Food plants.—Deciduous trees and shrubs generally.

Distribution.—N.S. to Vanc. Isl., Maine to Wash., Fla. to Calif.

Remarks.—This is a common species throughout its range, often occurring abundantly enough to be of economic importance and injurious to apple foliage. The larva is as follows: green, not particularly active, with broad, black or brown head. Thoracic shield green, or black with whitish cephalic margin, or green with brown margin. Thoracic legs black. As is typical in the subfamily, the larva is a leaf tier, webbing the terminal growth or young leaves together and living within this shelter. It is referred to in the economic literature as the oblique-banded leaf roller.

Choristoneura parallela Robinson

Figs. 165-166

Tortrix parallela Robinson, 1869, Trans. Am. Ent. Soc. 2: 267, Pl. 4, Fig. 17.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 415.

Archips parallela Rob., Fernald 1902, in Dyar, List N. Am. Lepid., p. 479.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 495.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem 101: 569.

Franklin, 1928, Mass. Agr. Expt. Sta., No. 239, p. 19.

Cacoecia parallela Rob., Holland, 1913, Moth Book, p. 422, Pl. 48, Fig. 31.

Meyrick, 1913, Gen. Insect., Fasc. 149: 26.

Choristoneura parallela Rob., Busck, 1931, Bull. Brooklyn Ent. Soc. 26: 210, Pl. 11, Fig. 11.

Similar to *rosaceana* Harr. in general colour and maculation but with more obsolete, fine reticulations and paler ground colour, causing the bands to appear more contrasting. The outer costal spot continued to the tornus. Costal fold of the male and scale-tuft of antennal scape absent. Undersurface of fore wing with fuscous shading in the region of the cubital vein. Expanse: male, 19-23 mm.; female, 22-25 mm. Moth from May to early July.

Male genitalia (Fig. 37).—Uncus much shorter and narrower than that of *rosaceana*; aedeagus without large teeth beyond the sheath; sacculus produced ventrally into a blunt tooth.

Female genitalia (Fig. 80).—Typical of the group, but with the antrum strongly inclined to the left.

Type locality.—Putman Co., N.Y.

Type.—American Museum Natural History. Male lectotype designated by Klots in 1942.

Food plants.—*Gardenia*, *Rosa*, *Myrica*, *Vaccinium*, *Phaseolus*, *Citrus*, *Solidago*, *Kalmia*.

Distribution.—S.W. Ont., Maine to Fla.; west to Calif. and Ill.

Remarks.—This is apparently a more southern species than *rosaceana* Harr.; it is commonly referred to as the spotted fire worm, a pest of cranberries in Mass. and N.J.

***Choristoneura obsoletana* Walker (n. comb.)**

Figs. 173-174

Teras obsoletana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 288.

Cacoecia transiturana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 312.

Walsingham, 1879, Ill. Lepid. Het. 4: 8, Pl. 62, Fig. 4.

Lozotaenia vesperana Clemens, 1865, Proc. Ent. Soc. Phila. 5: 136.

Tortrix sanbornana Robinson, 1869, Trans. Am. Ent. Soc. 2: 265, Pl. 1, Fig. 8.

Lozotaenia obsoletana Wlk., Walsingham, 1879, Ill. Lepid. Het. 4: 11, Pl. 63, Fig. 1.

Archips obsoletana Wlk., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 479.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 494.

Cacoecia obsoletana Wlk., Meyrick, 1913, Gen Insect., Fasc. 149, 25.

Male light ochereous with reddish-brown spots and reticulations. Female reddish-brown with purplish-black maculation. Basal patch obsolete; median band distinct on the costa, obsolete in the cell, and rather suffused beyond to the posterior margin of the wing. The hind wing either entirely sordid white, or entirely fuscous, or, more usually, fuscous on the posterior half and whitish anteriorly and apically. Fringes of all wings pale, shining. Undersurfaces pale, shining, with central area of the fore wing suffused with fuscous. Typical specimens of *obsoletana* Wlk. are smaller than *zapulata* Rob. and may represent only a subspecies. However, until the biologies of both are better understood, I prefer to treat the forms as at present listed. Expanse: male, 22-23 mm.; female, 22-25 mm. Moth in August.

Male genitalia (Fig. 38).—Uncus not so broad as in *rosaceana* Harr.; sacculus broad in the apical half; aedeagus with variable number of large teeth ventrally on the left side beyond the sheath (Fig. 38 A).

Female genitalia (Fig. 79).—Largely membranous behind the antrum.

Type locality.—North American (*obsoletana* Wlk., *transiturana* Wlk.); Virginia (*vesperana* Clem.); ? (*sanbornana* Rob.).

Type.—British Museum (*obsoletana* Wlk., *transiturana* Wlk.); Academy Natural Sciences Philadelphia (*vesperana* Clem.); ? (*sanbornana* Rob.).

Food plants.—*Gaylussacia*, *Fragaria*, *Rubus*, *Cassia*, *Asimina*.

Distribution.—N.S. and N.B., south to Fla., west to Tex., Ark., Nev., Utah.

Remarks.—This is another of Walker's troublesome names. He apparently described the male as *obsoletana* and the female as *transiturana*. Walsingham's illustrations of Walker's species did much toward the recognition of them, for they are unrecognizable from the meagre descriptions. The above synonymy, as established in present lists, appears correct.

In expanse this species approximates *parallela* Rob., with proportionately narrower fore wing. The narrow, rather pointed fore wing, particularly of the female with its two purplish-black costal spots and single blackish patch, the last representing the posterior part of the median band, readily identifies the species. It has been taken by McDunnough in the sphagnum bogs of N.S. and northern N.B. The following forms, *zapulata* Rob. and *seminolana* Kft., probably represent only subspecies of *obsoletana* Wlk., but until more is known of the biologies of the three, they will be treated as specifically distinct.

***Choristoneura zapulata* Robinson (n. comb.)**

Figs. 169-171

Tortrix zapulata Robinson, 1869, Trans. Am. Ent. Soc. 2: 264, Pl. 1, Fig. 7, male.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 416.

Tortrix symphoricarpana Kearfott, 1905, Can. Ent. 37: 92 (n. syn.).*Archips symphoricarpana* Kft., McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 57.*Cacoecia zapulata* Rob., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.*Archips zapulata* Rob., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 479.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 495.

In general appearance, this species is typical of the group but the fore wing more yellowish, with a distinct, satin-like sheen. The median band well marked on the costa but in the cell becoming either obliterated, or represented by the inner darker marginal line only; rarely, this band represented only on the costa. Both sexes with upper surface of the hind wing sordid white anteriorly and apically, and fuscous behind, with white fringe. A male specimen collected by K. M. King at Saskatoon, Sask., has entirely dark fuscous hind wings, but there is not sufficient material available to ascertain whether this condition is common to the species. Disc of fore wing with fuscous suffusion beneath. Expanse: male, 24-27 mm.; female, 27mm. Moth in early July.

Male genitalia (Fig. 39).—Similar to those of *obsoletana* Wlk. but with the aedeagus more strongly dentate.

Type locality.—Illinois.

Type.—American Museum of Natural History.

Food plants.—*Ceanothus*, *Comptonia*, *Vaccinium*, *Rosa*, *Fragaria*, *Trifolium*, *Symphoricarpos*.

Distribution.—Western Que. to B.C., N.J., Colo., Nev., Mont., Calif.

Remarks.—This form is decidedly larger than typical specimens of *obsoletana* and has a more distinct maculation. There is little difference in the genitalia and it may represent only a subspecies. Until more information is available on the biology of this complex, I prefer to treat this and the following form, *seminolana* Kft., as species. The name *symphoricarpana* Kft. applies to a dark-marked specimen of *zapulata* Rob. (Fig. 169). It was proposed for a few specimens from Medicine Hat, Alta.

***Choristoneura seminolana* Kearfott (n. comb.)**

Fig. 172

Tortrix seminolana Kearfoot, 1907, Trans. Am. Ent. Soc. 33: 71.

Meyrick, 1913, Gen. Insect., Fasc. 149: 29.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 415.

Cacoecia seminolana Kft. Barnes & McDunnough, 1917, Check List Lepid. Bor. Am. p. 177.*Archips seminolana* Kft., McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 57.

A small form, with short, broad wings, light reddish-ocherous in colour with darker reddish-brown striations and spots. The median band represented by a reddish-brown rectangular costal spot; behind this, the band, as in *zapulata* Rob., indistinct but rather vaguely represented near the posterior margin; a faint line extending, as in *parallela* Rob., from near the middle of the outer costal spot, almost straight to the tornus. However, *seminolana* lacking the distinctiveness of the median band in the cell as is characteristic of *parallela*. The hind wing of *seminolana* uniformly sordid white with a slight ocherous tinge toward the apex. Undersurface of hind wing pale; of fore wing, light ocherous, paler at the posterior margin. Expanse: 19-22 mm. Moth in June.

Genitalia.—Similar to those of *obsoletana*.

Type locality.—Florida.

Type.—American Museum of Natural History.

Food plant.—Unknown.

Distribution.—Va., Ga., Fla.

Remarks.—This form may represent only a subspecies, more material being necessary to ascertain the stability of the colour of the hind wings and the extension of the outer costal spot to the tornus. Biological data are required before the taxonomic status can be established.

SYNDEMIS Hübner

Syndemis Hübner [1825], Verz. bekannt. Schmett. (24), 382.

Fernald, 1908, Gen. Tort. Types, p. 11.

Tortrix Hbn., Meyrick, 1913, Gen. Insect., Fasc. 149: 27 (in part).

Tortrix Hbn., Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 491 (in part).

Dorsal abdominal pits absent. Costal fold of male present. Wing venation as in *Choristoneura* Led. Palpi slightly upturned. Socii present. Ductus bursae entirely membranous.

This genus is represented in North America by the single species *afflictana* Walker. This species almost identical in structure with the European type species, *musculana* Hbn., and the genitalia are similar. Consequently, I have not illustrated the genitalia of the type species. The maculation of *afflictana* Wlk. is more distinct than that of *musculana*, and not so brown. Otherwise the wing patterns are identical and the two forms may eventually be considered to be geographical subspecies.

Syndemis afflictana Walker (n. comb.)

Fig. 142

Sciaphila afflictana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 337.

Lozotaenia fuscolineana Clemens, 1865, Proc. Ent. Soc. Phila. 5: 137.

Tortrix fuscolineana Clem., Robinson, 1869, Trans. Am. Ent. Soc. 2: 266, Pl. 1, Fig. 11.

Lophoderus afflictatus Wlk., Walsingham, 1879, Ill. Lepid. Het. 4: 14, Pl. 63, Fig. 8.

Tortrix afflictana Wlk., Meyrick, 1913, Gen. Insect., Fasc. 149: 34.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta. Mem. 68: 492.

Head, thorax, abdomen, and fore wing grey, the last with darker reticulations and bands. The basal patch angled outwardly at the middle and narrowly edged outwardly with black; median band narrowly edged with black, more particularly on the inside; often appearing narrower on the costa because the posterior part is often blended into a darker area apically, and sometimes indistinct in this region; in some specimens the band of rather even width throughout, and the edges, particularly the inner one, relatively straight; a grey space between the basal patch and the median band having a slender, central, blackish-brown line; outer costal spot indistinct and hidden in the grey suffusion of the apical region, which is usually streaked with darker lines; fringe grey. Hind wing light fuscous, particularly in the apical region, and distinctly marked with short, darker striae; fringe light with dark basal line. Undersurface grey, the fore wing darker than the hind wing and both rather generally streaked with short, dark striae. Costal fold of male lanceolate and extending from the outer part of the basal patch to the inner side of the median band. Expanse: male, 16-20 mm.; female, 18-22 mm. Moth in the latter part of May and early June.

Male genitalia (Fig. 23).—Uncus, short, broad; socii well developed; arms of the gnathos elbowed; clasper narrowed apically, with rather broad sacculus that terminates acutely; aedeagus with ventral apical spine, three long cornuti, and a few small lateral teeth at the apical third.

Female genitalia (Fig. 72).—Operculum of ostium well developed and antrum in the median line; ductus bursae without sclerotized ribbon; signum small, without bulbous base.

Type locality.—St. Martin's Falls, Albany River, Hudson's Bay (Barnston) and N.S. (Redman); Virginia (*fuscolineana* Clem.).

Type.—British Museum (*afflictana* Wlk.); Academy of Natural Sciences Philadelphia (*fuscolineana* Clem.).

Food plants.—*Betula*?, *Abies*.

Distribution.—Nfld., N.S. to B.C., Maine to Va., Mo., Tex., Calif.

Remarks.—The wide distribution and similarity of structure of *afflictana* Wlk. and *musculana* Hbn. suggest an early origin and slow evolutionary development.

ARGYROTAENIA Stephens

Argyrotaenia Stephens, 1852, List Spec. Anim. Brit. Mus. 10: (Lep.) 67.

Fernald, 1908, Gen. Tort. Types, p. 36.

Pierce & Metcalfe, 1922, Gen. Tort. Lepid. Brit. Is., p. 1.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 490 (as a subgenus).

McDunnough, 1939, Check List Lepid. Can. & U.S.A., Pt. 2, p. 57. (*Argyrotaenia* Hbn. cited in error for *Argyrotaenia* Steph.).

Freeman, 1944, Sci. Agr. 25: 81.

The writer (1944) has already presented a review of most of the species in this genus. Continued study of the family has resulted in the inclusion and new combinations of the following species: *ivana* Fern. (Fig. 200); *purata* Meyr.; *franciscana* Wlshm. (Fig. 201); *provana* Kft. (Fig. 214), with *invidana* B. & Bsk. as synonym; and *dorsalana* Dyar (Figs. 196-197), with *dimorphana* B. & Bsk. as synonym (new synonymy).

The genus is redefined as follows: Palpus porrect, either clavate or triangular in outline. Venation as in *Choristoneura* Led. Thorax with or without posterior crest. Male antenna without basal notch. Dorsal abdominal pits absent. Male genitalia (Fig. 40) with clasper rounded ventrally and sacculus gradually tapering from the base; uncus open ventrally almost to the apex; cornuti numerous, short, broad, and pointed; socii present or absent. Female genitalia (Fig. 82) with the antrum reduced to a small pair of lateral, sclerotized plates; ductus bursae short, membranous throughout, usually with a sclerotized plate at its junction with the bursae. The genitalia of all the species in the genus are similar, and cannot be relied upon for specific recognition.

The following key supercedes the one in the writer's 1944 paper:

Key to the species of *Argyrotaenia* Steph.

1. Hind wing white, at least the costal half 2
Hind wing smoky, brownish, or tawny 7
2. Fore wing with a large, central, brown patch and with round, white or cream-coloured patches along the margin *alisellana* Rob. 3
Fore wing obliquely crossed by one or more fasciae 3
3. Fore wing with single, broad, often suffused median fuscia, or with this fascia reduced to a dark spot on the posterior margin 4
Fore wing with numerous, small, light-brown spots and two narrow, parallel brown fasciae *quercifoliana* Fitch 4
4. Median fascia poorly defined on the costa, often reduced to a posterior spot; ground colour of fore wing light straw-yellow *dorsalana* Dyar 5
Median fascia well defined on the costa 5
5. Second segment of labial palpus strongly tufted on the upper side and broadest at the middle, thus giving it a triangular profile 6
Second segment clavate, not tufted, widest at the apex *repertana* Free. 6
6. Hind wing slightly speckled at apex. A larger species 17-20 mm. in expanse *citrana* Fern. 7
Hind wing pure white at apex. A smaller species, 13-15 mm. in expanse *purata* Meyr. 7
7. Fore wing brown, or orange, with two narrow, parallel, darker fasciae 8
Fore wing more variegated, fasciae when present much broader 9
8. Fore wing bright orange *quadrifasciana* Fern. 8
Fore wing brown *juglandana* Fern. 8

9. Fore wing rust-coloured, with two or three very distinct, silvery-white costal streaks *miscana* Kft.
Fore wing without silvery-white costal streaks, although complete whitish fasciae may be present 10
10. Base of fore wing outstandingly ochereous to the inner edge of the median band, at least on costal half 11
Base of fore wing somewhat ochereous but not standing out as a distinct ochereous basal patch 12
11. Ochereous basal patch uniform over the whole basal area from costa to the dorsal margin. Rest of wing shining leaden-grey. Expanse, 19 mm. Described from California *gloverana* Wlshm.
Ochereous basal patch on costal half of fore wing only. Expanse, 14-16.5 mm. A few males and all females of *velutinana* Wlk.
12. Fore wing reddish-brown, irrorated with darker cross lines, or the bands of the wings with darker outer margins *tabulana* Free.
Fore wing not irrorated with darker cross lines, or the bands not distinctly margined with darker shades 13
13. Fore wing distinctly banded with reddish-brown, the outer margin of the basal patch extending from the posterior margin to the costa 14
Fore wing with traces of reddish-brown banding but not distinctly so, the outer margin of the basal patch not extending to the costa 15
14. Fore wing with a distinct, isolated black spot near the middle of the outer margin *ivana* Fern.
Fore wing with a light-brown extension of the outer costal spot near the middle of the outer margin *pinatubana* Kft.
15. Fore wing grey or greyish-white; basal patch usually obsolete; median fascia weak behind, very pronounced in costal region, where it is more or less joined to outer costal spot to form a large, elongate triangle that extends almost to apex of wing. Expanse, 18-23 mm. *mariana* Fern.
Fore wing greyish but not with large, elongate, costal triangle extending almost to apex of wing 16
16. Outer edge of basal patch distinct from dorsal margin to costa; fore wing generally grey with complete, whitish fascia 17
Outer edge of basal patch indistinct on costal half or absent 18
17. Inner edge of median band sharply defined with a narrow black line *provana* Kft.
Inner edge of median band not sharply defined *occultana* Free.
18. Basal area uniformly dark ochereous. Small, southwestern species. 13-15 mm. in expanse *franciscana* Wlshm.
Basal area not uniformly dark ochereous but speckled or finely streaked with black 19
19. Ground colour ochereous or greyish, with two blackish or dark-brown spots, the inner one representing the costal portion of the median band, which is reddish-brown below this spot. Banding not very distinct. Expanse, 11.5-14 mm *velutinana* Wlk.
Ground colour dark brown with purplish-brown bands; hind wing light reddish. Described from Florida *amatana* Dyar

Argyrotaenia velutinana Walker

Figs. 203-208

- Cacoecia* ? *velutinana* Walker, 1863, Cat. Lep. Het. 28: 313.
Cacoecia triferana Walker, 1863, Cat. Lep. Het. 28: 314.
Tortrix lutosana Clemens, 1865, Proc. Ent. Soc. Phil. 5: 138.
 Zeller, 1876, Verh. zool.-bot. Ges. Wien 25: 225.
Tortrix incertana Clemens, 1865, Proc. Ent. Soc. Phil. 5: 138.
 Robinson, 1868, Trans. Am. Ent. Soc. 2: 278, Pl. 6, Figs. 57, 58.
Tortrix velutinana Walker, Grote and Robinson, 1868, Trans. Am. Ent. Soc. 2: 83.
Lophoderus triferanus Walker, Walsingham, 1879, Ill. Lep. Het. 4: 15, Pl. 63, Fig. 9.
 Fernald, 1882, Trans. Am. Ent. Soc. 10: 15.
Lophoderus velutinana Walker, Fernald, 1882, Trans. Am. Ent. Soc. 10: 16.
Eulia triferana Walker, Fernald, 1902, in Dyar, List N.A. Lep., p. 485.
Eulia velutinana Walker, Fernald, 1902, in Dyar, List N.A. Lep., p. 485.
 Forbes, 1923, Cornell Univ. Ag. Exp. Stat., Mem. 68: 490.
 Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia velutinana Walker, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 57.

Freeman, 1944, Sci. Agri. 25: 83.

Argyrotaenia lutosana Clem., McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 57.

Because of the sexual dimorphism of this species, Walker (1863) and Clemens (1865), working independently at about the same time, both described the male and female as distinct species. A few years later, Robinson (1868) misidentified Clemens' *lutosana* and figured as this an undescribed species to which I gave the name *occultana* Free. In 1879, Walsingham recognized that all the names proposed by Walker and Clemens belonged to one species. Later authors have followed either Robinson or Walsingham but a recent examination of Clemens' types shows that his names are synonymous with one another and also with Walker's names, as judged from Walsingham's depiction of Walker's species.

In the Ottawa district there are two or possibly three generations a year with the largest number of individuals flying in late May or early June and again in July. The males of the spring generation are generally darker than those emerging later in the summer, this difference not being so apparent in the females. In general the male ochereous or greyish-ochereous with a rather poorly defined basal patch, usually distinct on the dorsal half only and angled outward at the fold; median band distinct, blackish or very dark brown on the costal half, brownish-ochereous on the dorsal half, the two halves being sharply defined; beyond this is the usual *Argyrotaenia* costal spot followed below, or prolonged into, a brownish-ochereous spot. In the female the basal patch is further reduced to a short, black spur representing the outer margin of that patch; and the whole area within, above to the costa, and outward to the inner edge of the median band is ochereous and stands out against the uniformly reddish-brown median band. Moth from March to July. Expanse: male, 11.5-14 mm.; female, 14-16.5 mm.

Type locality.—North America (*velutinana* Wlk., *triferana* Wlk.); Virginia (*lutosana* Clem.); unknown (*incertana* Clem.).

Type.—British Museum (*velutinana* Wlk., *triferana* Wlk.); Philadelphia Academy of Natural Sciences, (*lutosana* Clem., *incertana* Clem.).

Food plants.—The larva feeds generally as a leaf-tyer on almost any plant apparently, except conifers, and has been recorded, possibly in error on *Abies*.

Distribution.—Que., Ont., N.Y., Mass., Penna., Va., Tenn., Ga., Miss. La., Mo., Tex.

Remarks.—A pest in apple orchards, commonly known as the red-banded leaf roller.

***Argyrotaenia repertana* Freeman**

Figs. 209-213

Argyrotaenia repertana Free., 1944, Sci. Agri. 25: 84.

Head and thorax brownish-ochereous. Fore wing brownish-ochereous on a white ground, with darker median band and outer costal spot; basal patch brownish-ochereous, its outer margin angled outwardly at the fold, poorly defined throughout and extending to the costa; the area between the basal patch and the median band is concolorous with the basal patch on the costal half and becomes whitish on the dorsal half; median band oblique, reddish-brown, containing a minute spot of white at the middle of its outer margin; outer costal spot concolorous with the median band, the space between brownish-ochereous; terminal area from apex to tornus whitish; fringe brownish-ochereous. Hind

wing white, with slightly clouded anal area and light ochereous apex; fringe white with slightly darker basal line. Expanse: 15-19 mm. Moth in late May and June.

Type locality.—Waweig, N.B.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—*Aralia* sp.

Distribution.—N.S., N.B., Que., Man., Sask., Maine.

Remarks.—This species resembles, somewhat, the females of *velutinana* Wlk. and might be confused with it. However it is readily separated by its larger size and mostly white hind wings.

***Argyrotaenia pinatubana* Kearfott**

Figs. 215-220

Tortrix politana, Packard, 1890, Fifth Report U.S. Ent. Comm. p. 791 (life history).

Eulia pinatubana Kearfott, 1905, Can. Ent. 37: 9.

Forbes, 1923, Cornell Univ. Agri. Expt. Stat., Mem. 68: 490.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia pinatubana Kearfott, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 57.

Freeman, 1944, Sci. Agri. 25: 85.

Sexes similar. Head and thorax ochereous. Abdomen grey, blackish or mouse coloured with ochereous apical tufting more noticeable on the male. Fore wing with broad, well defined, orange to reddish-ochereous basal patch, the outer margin of which is distinct from costa to posterior margin; median band and outer costal spot well defined and concolorous with the basal patch, the median band usually with a lighter area near the middle of its inner margin; the bands are separated by a complete fascia of whitish or light ochereous which colour predominates in the apical region. Hind wing smoky, becoming paler basally; fringe paler with darker basal line. Expanse: male, 13-15 mm.; female, 14-18 mm. Moth from late April to early June.

Type locality.—Essex Co. Park, N.J.

Type.—American Museum of Natural History.

Food Plant.—The larva feeds on *Pinus*, binding the needles together to form a tube in which it lives. It is often injurious.

Distribution.—N.S., N.B., Que., Ont., Maine, N.J., N.Y., Mass., Fla.

Remarks.—Somewhat resembles *repertana* Free. and the females of *velutinana* Wlk. but is more distinctly banded.

***Argyrotaenia occultana* Freeman**

Figs. 221-226

Tortrix lutosana, Robinson, 1868, Trans. Am. Ent. Soc. 2: 279, Pl. 6, Fig. 59.

Argyrotaenia occultana Freeman, 1942, Can. Ent. 74: 57.

Brown and McGuffin, 1942, Can. Ent. 74: 60 (larva).

Freeman, 1944, Sci. Agri. 25: 86.

This is the species misidentified by Robinson and figured by him as *lutosana* Clem. Sexes similar. A moderate sized species with dark brown basal patch, median fascia, and outer costal spot; the spaces between these areas appearing as greyish or white fascia; outer margin of the basal patch distinct from the costa to the hind margin. In general colour it could only be confused with *mariana* Fern., the separating characters being noted in the key and accompanying figures. Expanse: 17-19 mm. Moth from May to early July.

Type locality.—Mt. Lyall, Que.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—*Picea*.

Distribution.—N.S., N.B., Que., Ont., Alta., N.Y.

***Argyrotaenia mariana* Fernald**

Figs. 245-247

Lophoderus mariana Fernald, 1882, Trans. Am. Ent. Soc. 10: 67.*Eulia mariana* Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Forbes, 1923, Cornell Univ. Agri. Expt. Stat. Mem. 68: 491.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia mariana Fernald, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 86.

Sexes similar. Head white, rarely grey. Thorax white or light ochereous with brown posterior crest. Abdomen whitish or grey with lighter apical tuft. Fore wing white with ochereous, brown, or black markings; basal patch mostly indistinct and indicated by a dark ochereous patch with angled black outer margin, that usually extends only to the middle of the wing and is most prominent at the hind margin; median band black, rarely brown on costal half where it often connects with the black, rarely brown outer costal spot in varying degrees of completion, below the middle the band is suddenly light brown, often indistinct along the outer margin; a light grey or light brown spot is usually present just above the tornus; rest of the wing white, finely striated with light ochereous and with short black striae along the hind and outer margins; fringe light ochereous. Hind wing smoky; fringe white with dark basal line. Expanse: 17-24 mm. Moth in May or June.

Type locality.—Described from four males from Orono, Me., Mass., and N.Y.

Type.—United States National Museum.

Food plants.—*Pyrus*, *Vaccinium*, and possibly *Quercus*.

Distribution.—N.S. to Ont., south to Fla.

Remarks.—A large whitish species, with the median band and outer costal spot black, and often united to form a large black costal triangle beyond the middle. It is often a pest in apple orchards.

***Argyrotaenia tabulana* Freeman**

Figs. 227-232

Argyrotaenia tabulana Free., 1944, Sci. Agri. 25: 87.

Sexes similar. Head, palpi, and thorax, light brown. Fore wing light brownish-grey with a pinkish cast and irrorated with dark reddish-brown lines; basal patch is represented by two dark reddish-brown angulated lines; median band oblique, a bit darker than the ground colour, with purplish cast, and bordered outwardly and inwardly with irregular reddish-brown distinct lines; costal spot beyond the median band reddish-brown, with darker inner and outer edges, and contiguous or slightly remote from a similarly coloured elongate spot above the tornus; beyond the costal spot one or two short dark reddish-brown preapical lines from the costa; fringe light reddish-brown. Hind wing smoky, becoming lighter toward the base; fringe light and with dark basal line and becoming tawny toward the apex. Underside of fore wing smoky with light ochereous costal and outer margins, and obliquely crossed with evenly spaced dark fuscous lines. Underside of hind wings white with several dark fuscous spots at the apex. Expanse: 13-17 mm. Moth from late April to early June.

This species exhibits a certain amount of variation of maculation. The ground colour varies from light brown to greyish and the median band may be represented only by the darker outer borders, or it may be considerably darker than the ground colour but with still darker distinct outer borders. The

maculation of this species somewhat resembles that of *pinatubana* Kft. Moth from late April to early June.

Type locality.—Constance Bay, Ont.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—*Pinus banksiana* Lamb.

Distribution.—Que., Ont., Man., B.C.

Remarks.—Mines jack pine needles, webbing two needles together and eating out the inside of one needle very thoroughly, causing the needle to appear cream coloured and making it very conspicuous.

Argyrotaenia citrana Fernald

Figs. 233-238

Tortrix citrana Fernald, 1889, Ent. Amer. 5: 18.

McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 57.

Argyrotaenia (Tortrix) citrana Fernald, Basinger, 1935, Cal. Agr. Mo. Bull. 24: 233.

Argyrotaenia citrana Fernald, Freeman, 1944, Sci. Agr. 25: 88.

A variable species with acute apex of fore wing. Ground colour of fore wing grey, reddish-brown or ochereous; basal patch darker than ground colour or absent; oblique median band blackish or dark brown, narrower on costal third and fading out on its outer edge posteriorly; outer costal spot distinct or absent; fringe light to dark ochereous. Hind wing white with a few short, dark, striae, more noticeable on outer half; fringe whitish, sometimes with darker basal line. Labial palpi with second joint tufted on upper side and broadest at the middle giving it a triangular lateral aspect. Expanse: 14-19 mm. Moth intermittently throughout the year.

Type locality.—California.

Type.—United States National Museum.

Food plants.—Orange and other citrus fruits, *Solidago*, *Salix*, *Geranium*, *Aquilegia*, *Crataegus*, *Rosa*, and *Asparagus*. Apparently a general feeder.

Distribution.—Calif., north in greenhouses to B.C.

Remarks.—A pest of considerable economic importance to the citrus fruits of California, and in greenhouses in British Columbia. Commonly known as the orange tortrix.

Argyrotaenia niscana Kearfott

Figs. 239-240

Eulia niscana Kearfott, 1907, Trans. Am. Ent. Soc. 39: 94.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Eulia camerata Meyrick, 1912, Ent. Mon. Mag. 48: 35.

Argyrotaenia niscana Kearfott, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 88.

Sexes similar. Head and thorax rust coloured. Abdomen grey-brown. Fore wing rust coloured with narrow, white fasciae and streaks; basal patch rust coloured, wide, its oblique outer margin slightly irregular and well defined from costa to hind margin; beyond the basal patch a narrow silvery-white complete fascia, often outlined in part with black; beyond, the wing rust coloured with a short silvery-white costal streak just beyond the middle, its posterior end curved abruptly outward and broken to include a round black dot, or continued to the tornus; near the apex of the costa, a short white streak, and still nearer the apex a light ochereous streak (sometimes broken) extending almost to the light ochereous tornal region; fringe light ochereous or tawny, darker at the apex. Hind wing entirely dark smoky, slightly striated with a darker shade; fringe lighter with dark basal line. Expanse: 15 to 18 mm. Moth from April to July.

Type locality.—Carmel, Calif.

Type.—American Museum of Natural History.

Food plant.—Unknown.

Distribution.—Calif.

Remarks.—Easily distinguished by its rust-red colour and outstanding silvery-white costal streaks.

***Argyrotaenia coloradana* Fernald**

Fig. 241

Lophoderus coloradana Fernald, 1882, Trans. Am. Ent. Soc. 10: 67.

Eulia coloradana Fernald, Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia coloradana Fernald, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 89.

Sexes apparently similar. Head and abdomen light ochreous. Thorax reddish-brown. Fore wing with broad, well defined, reddish-ocherous basal patch, the outer margin of the latter distinct from the costa to the posterior margin of the wing; median band distinctly reddish-brown, darker on the costa, becoming lighter behind, its inner margin narrowly but distinctly outlined with yellow, and deeply indented just below the radial vein; outer costal spot large, reddish-brown, contrasting with the white costal area on either side; between the bands and in the apical region of the wing, the white ground colour is obscured by streaks and patches of light ochreous; fringe light ochreous with white rays. Hind wing white, with smoky anal region, easily erased in spreading, or in poor specimens; fringe white. Expanse: 21-26 mm. Moth in July.

Type locality.—Colorado.

Type.—United States National Museum.

Food plant.—Unknown.

Distribution.—Colo., Utah, Ariz., Calif.

Remarks.—Easily recognized by the distinct reddish-brown outer costal spot which contrasts with the white ground surrounding it. Somewhat resembles *Archips argyrosipilus* Wlk. but the latter has the hind wings entirely smoky.

***Argyrotaenia quadrifasciana* Fernald**

Figs. 242-244

Lophoderus quadrifasciana Fernald, 1882, Trans. Am. Ent. Soc. 10: 67.

Eulia quadrifasciana Fernald, Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Forbes, 1923, Cornell Univ. Agri. Exp. Stat. Mem. 68: 491.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia quadrifasciana Fernald, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 90.

Sexes dimorphic. Male: Head, thorax and fore wing yellow, the last uniformly reticulate with orange and crossed by an antimedial and post-medial narrow, complete, purplish-brown (rarely orange) fascia; apical region suffused with purplish-brown; fringe light ochreous, dark in tornal region. Hind wing dark fuscous with darker basal line. Female: Like the male except the bands are orange (rarely purplish); apical region of fore wing reticulated with orange and hind wings brownish-orange. Fringes as in male. Expanse: male, 15-18 mm., female, 17-19 mm. Moth in June and July.

Type localities.—Me., N.H., Mass., N.Y., Ill.

Cotypes.—2 males, 1 female, in the United States National Museum.

Food plants.—*Crataegus*, *Amelanchier*, *Pyrus*, *Prunus*.

Distribution.—P.E.I. to Ont., Maine, Conn., Mass., Penn., Mich., Ill., Mo., Ark.

Remarks.—Easily distinguished by its orange-yellow colour with orange or purplish-brown bands.

***Argyrotaenia quercifoliana* Fitch**

Figs. 248-251

Argyrotaenia quercifoliana Fitch, 1858 Trans. N.Y. State Agr. Soc. 18: 826.

(Reprinted 1859, Fifth Rept. Noxious Insects N.Y., p. 46).

Tortrix (Argyrotoxa) trifurculana Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 226.

Meyrick, 1913, Gen. Insect., Fasc. 149: 29.

Eulia quercifoliana Fitch, Forbes, 1923, Cornell Univ. Agri. Exp. Stat., Mem. 68: 491.

Argyrotaenia quercifoliana Fitch, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 90.

Sexes similar. Creamy-yellow, finely dotted with light brown; two narrow, darker brown, oblique fascia, the post median one forked at the costa, and connected near its middle to a curved, subterminal, dark brown fascia, also forked on the costa just before the apex; fringe white or yellowish with darker basal line. Hind wing and fringe pure shining white. Expanse: male, 16-20, mm., female, 19-24 mm. Moth from May to July.

Type locality.—New York?

Type.—A male without abdomen in the United States National Museum.

Food plants.—*Quercus*, *Rhamnus*, *Hamamelis*.

Distribution.—Que. to Man. south to Tex. and Fla.

Remarks.—Some specimens (fig. 248) possess a light brown blotch near the middle of the fore wing and thus resemble *alisellana* Rob. However, the numerous light brown dashes in the basal and terminal areas of *quercifoliana* readily distinguish this species. Individuals rarely occur that are almost entirely light cream coloured, the brown maculation being obliterated.

***Argyrotaenia juglandana* Fernald**

Figs 252-255

Tortrix (Lophoderus) juglandana Fernald, 1879; Can. Ent. 11: 155.

Eulia juglandana Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Forbes, 1923, Cornell Univ. Agri. Exp. Stat., Mem. 68: 491.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia juglandana Fernald, McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 91.

Sexes quite similar. Male: fore wing brown, inclined to be speckled and crossed by two narrow, dark brown, oblique fascia wider on the costa; fringe dark brown to blackish, becoming light toward the apex. Hind wing and fringe, shining fuscous. Female darker brown than the male with no speckled appearance. Expanse: male, 17-19 mm., female, 21-26 mm. Moth in June and July.

Type locality.—Described from 11 males and 15 females from the following localities: Mass., N.Y., Ont., Ohio. Wis. Part of the type series was reared from Hickory by J. Angus of West Farms, N.Y.

Cotypes.—3 males, 3 females, in the United States National Museum.

Food plants.—*Carya*, also recorded on *Viburnum* and *Prunus*.

Distribution.—Que., Ont., Conn., Mass., Penna., Fla., Ill., Minn.

Remarks.—This is the largest species in the genus. Full grown larvae occur in a longitudinally rolled hickory leaf in the latter half of June and pupate beneath the bark along the trunk of the tree.

***Argyrotaenia amatana* Dyar**

Fig. 256

Lophoderus amatana Dyar, 1901, Jour. N.Y. Ent. Soc. 9: 24.*Eulia amatana* Dyar, Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia amatana Dyar, McDunnough, 1939, Check List Lep. Can. and U.S.A. Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 91.

Head and thorax reddish-brown. Fore wing brownish-orange with purple-brown basal patch, median band and outer costal spot, the first not reaching the costa; terminal space whitish. Hind wing orange, fading basally and of the same colour as that of the hind wing of the female of *quadrifasciana* Fern.

This species is easily recognized by the orange brown colour of both fore and hind wings and in size approaches *velutiana* Wlk. Expanse: male, 13 mm., female, 18-19 mm.

Type locality.—Palm Beach, Florida.

Type.—United States National Museum.

Food plants.—Recorded by Dyar, 1901, op. cit., as bred from *Annona glabra* Linn. = *laurifolia* Duval. and, *Nectandra coriacea* (Sw.) Griseb. = *Wildenoviana* Nees. Also avocado (U.S.N.M. record). According to Dyar the larva ties up the leaves with a series of transverse walls of web, leaving a round hole in each web near the leaf for the larva to pass through.

Distribution.—Florida.

Remarks.—The only specimen the author has of this species is a rather worn male from Perrine, Florida, June 8, 1923, G. F. Maznette Coll., reared from avocado and kindly loaned for study by the authorities of U.S.N.M. through the late Mr. Carl Heinrich.

***Argyrotaenia alisellana* Robinson**

Figs. 257-258

Tortrix alisellana Robinson, 1869, Trans. Am. Ent. Soc. 2: 267, Pl. 1, Fig. 15.*Eulia alisellana* Robinson, Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Holland, 1913, Moth Book, p. 423, Pl. 48, Fig. 39.

Forbes, 1923, Cornell Univ. Agri. Exp. Stat., Mem. 68: 491.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia alisellana Robinson, McDunnough, 1939, Check List Lep. Can. and U.S.A. Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 92.

Sexes similar. Head and thorax white. Fore wing light brown with white or cream coloured basal third, that sometimes contains a few light brown scales, and with marginal, pure white or cream coloured, rounded blotches as follows: One at the middle of the costa, one at the costal four-fifths, one at the middle of the outer margin, and one smaller one just before the tornus on the hind margin. Hind wing white. Fringes white. Expanse: 18-24 mm. Moth in June, July and August.

Type locality.—Ohio.

Type.—Probably lost.

Food plant.—*Quercus*.

Distribution.—Que., Ont., N.Y., N.J., Va., Fla., Penna., Ohio, Tenn., Ind., Ill., Wisc.

Argyrotaenia gloverana* WalsinghamLophoderus gloveranus* Walsingham, 1879, Ill. Lep. Her. 4: Pl. 63, Fig. 7.*Eulia gloverana* Walsingham, Fernald, 1902, in Dyar List N.A. Lep., p. 485.

Meyrick, 1913, Gen. Insect., Fasc. 149: 39.

Argyrotaenia gloverana Walsingham, 1939, McDunnough, Check List Lep. Can. and U.S.A. Pt. 2, p. 58.

Freeman, 1944, Sci. Agri. 25: 92.

Very little appears to be known about this Californian insect and it is absent from most collections. The author has never seen it, his key characters being based entirely upon the original description and figure, the former of which reads as follows: "Head whitish-grey, thickly clothed above and in front; palpi whitish-grey, brownish at the sides, projecting the length of the head beyond it; antennae slightly pubescent; thorax with a raised ferruginous tuft of scales at the back; patagia of the same colour. Fore wings—with the costa arched; apical margin very oblique, slightly emarginate below the apex—rather shining leaden-grey, with a ferruginous patch at the base extending over one fourth of the wing, extremely margined with brownish-fuscous; an irregular, waved, greyish-fuscous fascia about the middle, clearly defined only on its inner edge; beyond and before it are some transverse streaks and lines of brownish-fuscous, especially towards the apex; the apical portion of the costa clothed with brownish-fuscous, and some streaks of the same colour running through the grey cilia. Hind wings pale brownish-fuscous; cilia paler, one male. Expanse of wings 19 mm."

Type locality.—Near Mount Shasta, California, Sept. 3rd, 1871.

Type.—British Museum.

Food plant.—Unknown.

Remarks.—The description and figure of this species suggest that it is a form of *Acleris variana* Fern.

***Argyrotaenia ivana* Fernald (n. comb.)**

Fig. 200

Tortrix ivana Fernald, 1901, Jour. N.Y. Ent. Soc. 9: 51.

Head, thorax, and ground colour of fore wing light ochereous, the last lustrous with light brown markings. Male more distinctly marked than the female. Basal patch brown, angled outwardly above the middle and inwardly at the middle, and becoming indistinct on the posterior margin; median band brown, extending from the costa obliquely outward to the middle of the wing; outer costal spot distinct, brown, subtriangular, the lower apex sometimes connected to the outer corner of the median band; behind the outer costal spot, in the middle of the wing, a small, subapical, brown spot; outer margin of wing with a fine brown line at middle; fringe ochereous. Hind wing light fuscous with darker striations, particularly noticeable in the apical half; fringe shining, sordid white, with dark basal line. Undersurface of fore wing shining light fuscous; hind wing similar with darker striations. Expanse: 12-14 mm. Moth in March and August.

Type locality.—Florida.

Type.—United States National Museum.

Food plants.—*Iva*, *Apium*.

Distribution.—Fla.

Remarks.—Rarely, some females are rather uniformly ochereous, with an indication of a darker median band and outer costal spot only. The species is a pest of celery in the Everglades.

***Argyrotaenia purata* Meyrick (n. comb.)**

Tortrix purata Meyrick, 1930, Exot. Microlep. 4: 254.

Head and thorax brownish-ochereous. Fore wing brownish-ochereous with fuscous markings and striations; basal patch obscure, often marked only by an

outwardly angled line representing the outer margin; median band fuscous, oblique, more distinct on the costal half; outer costal spot elongate, triangular; fringe light ochereous with dark basal line. Hind wing and fringe whitish. Undersurface of fore wing as of upper surface but lighter; of hind wing whitish. Expanse: 14-19 mm. Moth in May and June.

Type localities.—Venice, Calif.; Ariz.

Type.—British Museum.

Food plant.—Unknown.

Distribution.—Calif., Ariz.

Remarks.—This species resembles *peritana* Clem., but it may be distinguished by the white hind wings.

Argyrotaenia franciscana Walsingham

Fig. 201

Lozotaenia franciscana Wlshm., 1879, Ill. Lepid. Het. 4: 13, Pl. 63, Fig. 5.

Tortrix franciscana Wlshm., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 483.

Male.—Head and thorax light grey. Fore wing sordid white with distinct brownish or fuscous markings and acute apex; basal patch distinct, broad, its outer margin dentate at the middle; median band oblique, extending from near the middle of the costa to the tornus; outer costal spot distinct, triangular; outer margin with fuscous streak extending from the apex to the tornus, where it joins the outer edge of the median band; fringe sordid white, fuscous at apex of the wing. Hind wing light fuscous; fringe white. Undersurface of fore wing light fuscous; of hind wing whitish. Expanse: 12-16 mm. Moth in March and April.

Female.—Not definitely known to the writer. Two females, probably of this species, that were reared from *Lupinus*, the food plant of the male, near San Francisco, Calif., have light brown fore wings with the median band and the outer costal spot darker; the hind wings are light fuscous.

Type locality.—San Francisco, California.

Type.—British Museum.

Food plant.—*Lupinus*.

Distribution.—Calif.

Remarks.—Walsingham described this species from two males. Females are absent in most collections, or are indistinguishable from females of other species, and they are possibly mixed with them. The fore wings of the females mentioned above resemble those of *citrana* Fern.

Argyrotaenia provana Kearfott (n. comb.)

Fig. 214

Olethreutes provana Kearfott, 1907, Trans. Am. Ent. Soc. 33: 16.

Argyroploce provana Kft., 1917, Barnes and McDunnough, Check List Lep. Bor. Amer., p. 169.

Tortrix provana Kft., McDunnough, 1939, Check List Lep. Can. and U.S.A., Pt. 2, p. 57.

Tortrix invidana Barnes and Busck, 1917, Contr. Lep. N. Amer. 4: 215.

Blackmore, 1921, Rept. B.C. Prov. Mus. p. 25, Pl. 2, Fig. 9.

Head and thorax whitish. Posterior thoracic tuft black. Fore wing sordid white with light fuscous markings; basal patch indented below middle, often expanded suddenly on posterior margin, and usually enclosing a white area at extreme wing base; median band only slightly oblique from the middle of the costa to the pretornal region; irregular, often strongly constricted at the middle; outer costal spot broad, subquadrate; usually an elongate spot between outer costal spot and tornus; fringe greyish-fuscous with darker basal line. Hind wing light brown to very light fuscous; fringe whitish, with darker basal line. Undersurface of fore wing light brown with lighter costal striations; of hind

wing whitish, with brown, apical striations. Expanse 17-21 mm. Moth from April to September, most abundant in July.

Type locality.—Wellington, B.C. (Vancouver Island, B.C., *invidana* B. & Bsk.).

Type.—American Museum of Natural History (Abdomen lost).

Food plant.—Unknown.

Distribution.—B.C., Wash.

Remarks.—The species is readily recognized. It is rare in collections.

***Argyrotaenia dorsalana* Dyar (n. comb.)**

Figs. 196-197

Tortrix dorsalana Dyar, 1903, Proc. Ent. Soc. Wash. 5: 231.

Tortrix dimorphana Barnes and Busck, 1920, Contr. Lep. N. Amer. 4: 215.

Head and thorax light ochereous. Fore wing shining, light straw-yellow, rarely ochereous; basal patch absent; median band fuscous, poorly defined or absent on costa, usually broken near middle and broader on posterior margin, sometimes represented only by a fuscous spot on posterior margin; outer costal spot fuscous, rarely absent; tornal region sometimes with a line of fuscous; fringe concolourous with ground colour. Hind wing and fringe white. Under-surface of fore wing light yellow; of hind wing white. Expanse: 18-24 mm. Moth in June and July.

Type locality.—Williams, Arizona.

Type.—United States National Museum.

Food plant.—*Quercus*.

Distribution.—Ariz., Calif., Oreg., Wash., B.C.

Remarks.—This species has a coastal distribution in the northern portion of its range.

BATODES Guenée

Batodes Guenée, 1845, Europ. Microlepid. Ind. Meth., p. 40.

1845, Ann. Soc. Ent. France (2) 3: 174.

Meyrick, 1913, Gen. Insect., Fasc. 149: 10.

Fernald, 1908, Gen. Tort. Types, p. 31.

Palpus slightly ascending. Scutellum with well-developed crest. Male with costal fold. Fore wing with veins R_1 and R_2 stalked. Hind wing with R and M_1 stalked. Dorsal abdominal pits absent.

Male genitalia (Fig. 22).—Uncus short, broad, with slightly concave apex; socii present, drooping; gnathos arms rather straight, their apices fused to form a flat, shoe-like structure; transtilla simple, with median dorsal projection; clasper broad; sacculus extended as a broad fold to the outer four-fifths; aedeagus pistol-shaped, cleft, and with three short, broad cornuti.

Female genitalia (Fig. 81).—Sterigma very broad, funnel-like, without well-differentiated antrum; ductus bursae entirely membranous.

In North America this genus is represented only by *angustiorana* Haw. This species may represent a comparatively recent introduction, as it was first recorded in North America by Clarke in 1929.

***Batodes angustiorana* Haworth**

Figs. 198-199

Batodes angustiorana Haworth, 1811, Lepid. Brit. p. 429.

Clarke, 1929, Rept. B.C. Prov. Mus., p. 13, Pl. 3, Fig. 3.

Keifer, 1933, Mon. Bull. Calif. Dept. Agr. 22: 351.

Male.—Costal fold well developed. Head and thorax dark brown. Fore wing with ochereous ground colour, brown basal spur, median band, and outer costal spot; basal patch represented by a short thick spur, extending from near

the base of the hind margin to the centre of the wing at the basal one-quarter; this spur separated from the dark-brown costal fold by a light area of the ground colour, that extends around the spur to the posterior margin and forms a light triangular patch; oblique median band narrowly margined with pale-ocherous scales, its inner margin rather straight but the apical margin very irregular and often suffusing with the darker apical region; outer costal spot outlined with pale scales and continuing below as a curved streak to the tornal region; this streak also outlined inwardly by light scales, and this outlining of the bands and spots causing a speckled appearance of the fore wing; apical region of the wing ocherous and also margined with light scales. Hind wing uniformly dark brown with lighter fringe. Expanse: 12-15 mm.

Female.—Head and thorax light brown. Fore wing pattern similar to that of the male but the colours lighter; beneath the outer costal spot, some black dashes, separated by lighter scales outlining the veins. Hind wing as in the male. Expanse: 14-17 mm. Moth from May (Calif.) to early July (B.C.).

Male and female genitalia (Figs. 22, 81).—Described in the generic description.

Type locality.— ?

Type.— ?

Food plants.—*Taxus* in North America. *Taxus* and *Pyrus* in England.

Distribution.—Coastal regions from southern B.C. to Calif.

ADOXOPHYES Meyrick

Adoxophyes Meyrick, 1881, Proc. Linn. Soc. New South Wales 6: 429.

Fernald, 1908, Gen. Tort. Types, p. 42.

Meyrick, 1913, Gen. Insect., Fasc. 149: 18.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 479.

Palpus porrect, the second joint heavily scaled above. Male with well-developed costal fold. R_1 and R_2 stalked and forked near the apex; Cu_1 arising remote from the cell angle. Hind wing with R and M_1 stalked; M_3 and Cu_1 separate. Dorsal abdominal pits absent.

Male genitalia (Fig. 42, type species, *beteroidana* Meyr.).—Uncus enlarged and rounded apically; socii well developed, pendulous; gnathos arms strongly elbowed, apices fused; transtilla coarsely dentate on each side, divided; clasper oblong; sacculus weak; aedeagus tubular with numerous long cornuti.

Female genitalia (Fig. 86, type species, *beteroidana* Meyr.).—Sterigma and antrum, small; similar to those of *Ptycholoma* Steph; signum small.

The genus is represented by several species in the Indo-Australian region. In North America the genus is represented by two species.

Key to the species of *Adoxophyes* Meyrick

1. Short transverse reticulations brownish, distinct, outstanding; median band oblique, outlined with dark brown, contrasting with the lighter ground colour. *furcatana* Wlk.
Short transverse reticulations obscure or absent; median band not contrasting or outlined with dark brown *negundana* McD.

***Adoxophyes furcatana* Walker**

Fig. 175

Dichelia furcatana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 319.

Tortrix furcatana Wlk., Robinson, 1869, Trans. Am. Ent. Soc. 2: 270, Pl. 4, Fig. 27.

Tortrix (Dichelia) furcatana Wlk., Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 232.

Capua furcatana Wlk., Walsingham, 1879, Ill. Lepid. Het. Brit. Mus. 4: 21, Pl. 65, Fig. 4.

Adoxophyes furcatana Wlk., Meyrick, 1913, Gen. Insect., Fasc. 149: 18.

Forbes, 1925, Cornell Univ. Agr. Expt. Sta., Mem. 68: 479.

Head, thorax, and fore wing shining straw-yellow, the last finely reticulate

and banded with golden-brown. The median band irregular and margined on both sides with dark brown; slightly wider on the costal and posterior margins; a thin dark line extending from the middle of this band to the basal fourth of the posterior margin; outer costal spot golden-brown and connected by a doubly arcuate, dark streak to the tornal region and joining the outer part of the median band; fringe shining, light ochreous. Hind wing and fringe shining white. Undersurfaces of wings white, with faint indications of the bands of the upper surface. Expanse: male, 16-18 mm.; female 18-21 mm. Moth from June to August.

Male genitalia (Fig. 43), *female genitalia* (Fig. 87).—Previously discussed in the generic definition.

Type locality.—North America (Carter).

Type.—British Museum.

Food plant.—*Platanus*.

Distribution.—East of the Mississippi Valley, north to the southwestern peninsula of Ontario.

Remarks.—The larva draws a leaf together longitudinally along the main vein, thus forming a longitudinal trough along the underside of the leaf. It gathers the downy pubescence into a sort of nest at the end of the trough. Pupation occurs in this nest. The larva is light green, with an ivory-coloured head, and is extremely active when disturbed.

***Adoxophyes negundana* McDunnough**

Fig. 176

Homona negundana McDunnough, 1923, Can. Ent. 55: 166.

Adoxophyes negundana McD., McDunnough, 1939, Check List Lepid. Can. and U.S.A., Pt. 2, p. 54.

Similar to *furcatana* Wlk., but much paler. The fine, transverse reticulations almost imperceptible on the creamy-white ground colour; median band and outer costal spot light golden-ocherous and not margined by darker shades; median band broader than that of *furcatana* and the inner spur to the posterior margin sometimes absent; outer costal spot extending to the tornus as an elongated triangle, straight on its inner side and rather distinct outwardly; fringe shining light ochreous. Hind wing white, as in *furcatana*. Expanse: 16-20 mm. Moth from June to early September.

Male genitalia.—Similar to those of *furcatana* Wlk., but with only four cornuti and with more sharply elbowed gnathos arms.

Type locality.—Aweme, Manitoba.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—*Acer negundo* L.

Distribution.—Ont. to Man., N.Y. to Fla., Colo., Utah, Ill., Kan., Iowa.

Remarks.—This species is frequently confused with *furcatana* Wlk. which it closely resembles.

PTYCHOLOMA Stephens

Ptycholoma Stephens, 1829, Nom. Brit. Ins., p. 47 (nom. nud.).

Stephens, 1834, Ill. Brit. Ent. Haust. 4: 141.

Westwood, 1840, Syn. Gen. Brit. Ins., p. 108.

Fernald, 1908, Gen. Tort. Types, p. 24.

Smicrotes Clemens, 1860, Proc. Acad. Nat. Sci. Phila., p. 355.

Tortrix Linn., Meyrick, 1913, Gen. Insect., Fasc. 149: 27 (in part).

Cnephasia Curtis, Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 488 (in part).

This genus is represented in North America by three species. The moths are small, varying in wing expanse from 10 to 17 mm. They have the usual

archipine maculation, consisting of a basal patch, an oblique median band, and an outer costal spot. Palpus porrect, with the second joint tufted dorsally. The moths are usually recognized by the stalked condition of R and M of the hind wing, although occasional specimens occur with these two veins free. Dorsal abdominal pits absent. Costal fold of male absent or narrowly extended along the costa.

Male genitalia (Fig. 45, type species, *lecheana* Linn.).—Uncus long, narrowly necked, with enlarged, rounded apex; socii present or absent; gnathos arms long, slightly curved, their apices fused for a short distance; transtilla partially divided, dentate or finely spinose; clasper subtriangular, with poorly developed sacculus that extends half-way along the ventral margin; aedeagus short, broad, with one thin or two thick cornuti.

Female genitalia (Fig. 83, *lecheana* Linn.).—Sterigma with a small antrum consisting of two small, sclerotized lateral pieces; sclerotized ribbon of ductus bursae absent. The genus is divisible into two parts: the first represented by *peritana* Clem., and the second by *virescana* Clem. and *glaucana* Wlshm., as outlined in the following key.

Key to the species of *Ptycholoma* Stephens

1. Transtilla coarsely dentate on each side; one short, thin cornutus. Signum absent.
Costal fold of male absent. Median band continuous across the wing *peritana* Clem.
Transtilla finely spinose on each side; two coarse, long cornuti. Signum present.
Costal fold of male present, narrow. Median band broken in the cell or indistinct 2
2. Median band distinct on costa, contrastingly blackish, and broken in the cell. Intergrading with *virescana* Clem. *glaucana* Wlshm.
Median band not so distinct on costa, brownish; usually entire and suffused.
Intergrading with *glaucana* Wlshm. *virescana* Clem.

Ptycholoma peritana Clemens (n. comb.)

Fig. 177

Smicrotes peritana Clemens, 1860, Proc. Acad. Nat. Sci. Phila., p. 356.

Tortrix peritana Clem., Robinson, 1869, Trans. Am. Ent. Soc. 2: 277, Pl. 6, Fig. 52.

Meyrick, 1913, Gen. Insect., Fasc. 149: 30.

Dichelia inconclusana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 318.

Cnephasia peritana Clem. Forbes, 1923, Cornell, Univ. Agr. Expt. Sta., Mem. 68: 488.

Costal fold absent. Head, thorax, and fore wing ochereous, the last with brown transverse striations and median band, and blackish outer costal spot. Basal patch faintly indicated outwardly by a fine, excurved brown line; median band distinct inwardly, where it is often margined by a light line; constricted below the costa; diffused outwardly and broadest on the posterior margin; in some specimens the inner margin angling slightly to meet the posterior margin at a right angle; outer costal spot dark brown or blackish, triangular, and widest on the costa usually joined to the tornus by a fine brown line; fringe shining ochereous. Hind wing slightly fuscous, with shining whitish fringe. Expanse: 10-15 mm. Moth from May until September, more common in July and August.

Male genitalia (Fig. 44).—Apex of uncus oval; transtilla with a cluster of four or five coarse teeth on each side; sacculus short and narrow; aedeagus short, angled, with one thin cornutus.

Female genitalia (Fig. 85).—Ventral plate narrow, slightly extended laterally to form two anterior protuberances; antrum short; signum absent.

Type locality.—?

Type.—Academy of Natural Sciences of Philadelphia (*peritana* Clem.); British Museum (*inconclusana* Wlk.).

Food plant.—*Fragaria*.

Distribution.—N.S. to B.C., Maine to Fla., west to Ariz., Colo., Utah, Calif.

Remarks.—This is a common species and is often confused with the other species in the genus. Some eastern specimens are smaller than others and show a pale edging of the inner side of the median band. Larger eastern specimens do not show this pale margin. Both forms become larger in north-western localities. A small form occurs in Texas with blackish-brown median band and outer costal spot; the inner edge of the median band is edged with a pale line and the base of the wing often contains a small blackish spot.

***Ptycholoma virescana* Clemens (n. comb.)**

Fig. 178

Smicrotes virescana Clemens, 1865, Proc. Ent. Soc. Phila. 5: 140.

Tortr. (Loxot.) sescuplana Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 220.

Archips virescana Clem., Fernald, 1902, in Dyar, List. N. Am. Lepid., p. 481.

Tortrix virescana Clem., Meyrick, 1913, Gen. Insect., Fasc. 149: 30.

Cnephasia virescana Clem., Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 488.

Male costal fold present, narrow, with elongate scales behind. Ground colour of fore wing similar to that of *peritana* Clem., but more olivaceous and the markings less distinct. Hind wing and wing expanse as in *peritana*. Moth from April (Arkansas) to July.

Male genitalia (Similar to *glaucana* Wlshm., Fig. 46).—Uncus more robust than that of *peritana* Clem., with the apex more arcuate; sacculus broader and longer; transtilla with a group of minute spines on each side; aedeagus broad, straight, with two large cornuti.

Female genitalia (Similar to *glaucana* Wlshm., Fig. 84).—Ventral plate broad, bulbous, roughened near ostium, signum present.

Type locality.—?

Type.—Academy of Natural Sciences of Philadelphia (*virescana* Clem.).

Food plant.—Unknown

Distribution.—N.S. to E. Ont.; Maine south to N.C.; west to the Mississippi Valley and Ariz.

Remarks.—This species is distinguished from *peritana* Clem. by the presence of a male costal fold and the genitalic characteristics outlined above.

***Ptycholoma glaucana* Walsingham (n. comb.)**

Fig. 179

Loxotaenia glaucana Walsingham, 1879, Ill. Lepid. Het. 4: 13.

Archips glaucana Wlshm., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 481.

Tortrix glaucana Wlshm., Meyrick, 1913, Gen. Insect., Fasc. 149: 30.

Very close to *virescana* Clem. Vaguely differentiated by the black costal portion of the median band, and blacker outer costal spot. These characters intergrade with those of *virescana* Clem.

Genitalia (Fig. 46, 84).—Similar to *virescana* Clem. See above.

Type locality.—Southern Oregon.

Type.—British Museum ? Described from two males and one female captured in mid-May, 1872.

Food plant.—Unknown.

Distribution.—Calif. to B.C., east to Tex. and Ont.

***CLEPSIS* Guenée**

Clepsis Guenée, 1845, Ann. Soc. Ent. France 2: 168.

Stainton, 1858, Manual 2: 197.

Fernald, 1908, Gen. Tort. Types, p. 31.

Tortrix Linn., Meyrick, 1913, Gen. Insect., Fasc. 149: 22 (in part).

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 498 (in part).

Cacoecia Hbn., Meyrick, 1913, Gen. Insect., Fasc. 149: 22 (in part).

Costal fold present or absent. Palpi porrect or upturned. Dorsal abdominal pits venation. Venation as in *Choristoneura* Led. Male antenna strongly or moderately ciliated.

Male genitalia (Fig. 47 type species, *rusticana* Tr.).—Uncus very broad, short, broadly attached to tegumen; gnathos arms short, curving inward, apices fused for a considerable distance; tegumen well developed; transtilla almost or completely separated into two spinose or dentate lobes and attached to the middle of the clasper as well as to the vinculum; cornuti variable in number.

Female genitalia (Figs. 88-93).—Ostium wide; eighth ventral plate short and broad behind the ostium; sclerotized ribbon in ductus bursae either present for total length, or in bursal half only, or entirely absent.

This genus is represented in North America by seven medium-sized species, with the fore wing ochereous or reddish-ochereous. I do not consider that the species placed in this genus represent a natural group. When the world fauna is better known, it will be possible to place them correctly. In the meantime, I have assigned them to the genus *Clepsis* on the basis of the morphological similarities outlined above.

Key to the species of *Clepsis* Guenée

1. Fore wing with a bright, silvery-white, triangular spot slightly beyond the middle of the costa *persicana* Fitch 2
Fore wing without such silvery-white costal spot 2
2. Fore wing entirely bright, shining ochereous-yellow *clemensiana* Fern. 3
Fore wing not entirely ochereous yellow 3
3. Fore wing ochereous-yellow and with large, dark-purple blotches *flavidana* McD. 4
Fore wing not as above 4
4. Fore wing with the costal area whitish or light ochereous from the base to the outer dark costal spot, and with a large, suffused, ochereous-brown blotch containing metallic blue scales, near the tornus on the posterior margin *melaleucana* Wlk. 5
Costal area not whitish; usually crossed by a darker median band 5
5. Hind wing entirely white, without dark striae *fucana* Wlsh. 6
Hind wing fuscous at least in part, or whitish in part, with short, darker striae 6
6. Median band continuous across the wing; its outer margin rather indistinct and suffusing gradually into the ground colour beyond; ground colour ochereous-yellow *busckiana* Kief. 6
Median band often broken in the cell, its outer margin sharply defined; or wing entirely greyish fuscous, or reddish-brown with indistinct median band *moeschleriana* Wocke 6

Clepsis persicana Fitch (n. comb.)

Figs. 182-183

Craesia persicana Fitch, 1856, Trans. N.Y. State Agr. Soc. 16: 357.

Craesia persicana Fitch, 1859, Third Rept. Ins. N.Y. 39, Sect. 62.

Archips persicana Fitch, Fernald, 1902, in Dyar, List N. Am. Lepid., p. 48.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 497.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 569.

Cacoecia persicana Fitch, Meyrick, 1913, Gen. Insect., Fasc. 149: 24.

Ditula ? blandana Clemens, 1864, Proc. Ent. Soc. Phila. 3: 515.

Lozotaenia fragariana Packard, 1869, Guide Stud. Ins., p. 335.

Tortr. (Argyrot.) conigerana Zeller, 1875, Verh. zool.-bot. Ges. Wien 25: 227.

Head and thorax ochereous-tawny. Costal fold well developed, broad basally, gradually convex and tapering toward white costal spot. Fore wing ochereous-tawny from base to inner edge of median band, faintly striated with darker tawny lines; median band reddish-brown, fusing at the tornus with a

similarly coloured, broad band that extends to the costa near the apex; the two bands enclosing a large, triangular, silvery-white costal spot that is concave outwardly; outer margin of the wing light ocherous with ruddy speckles; fringe light ocherous. Hind wing entirely smoky except narrowly along the costa; fringe whitish with dark basal line. Undersurface of fore wing dark fuscous with white costal spot and ocherous outer margin; of hind wing white, with apical or marginal, round, ocherous or brownish spots. Expanse: 19-22 mm. Moth in late June and early July.

Male genitalia (Fig. 49).—Uncus broad, rounded; socii well developed, drooping; gnathos arms fused to form a keel-like projection; transtilla finely toothed, almost divided along the median line; clasper broad, oblong, with sacculus margin turned outwardly at its apical half.

Female genitalia (Fig. 89).—Ostium with well-developed operculum; antrum funnel-like, opening toward the right; ductus bursae with sclerotized ribbon in bursal half only.

Type locality.—New York ?

Type.— ?

Food plants.—Apparently a general feeder on coniferous and deciduous plants.

Distribution.—Goose Bay, Lab., N.S. to B.C., Alaska to Calif., Maine to Va., Minn.

Remarks.—In Alberta and British Columbia, a form occurs with a reduced white costal spot. It flies with typical individuals but its true taxonomic status is not known. There is apparently no anatomical difference between it and the typical form.

Clepsis busckana Keifer

Fig. 180

Clepsis busckana Keifer, 1933, Mo. Bull. Calif. Dept. Agr. 22: 351, Pl. 1, Figs. 1, 2.

Tortrix busckana Keif., McDunnough, 1939, Check List Lepid. Can. and U.S.A. Pt. 2, p. 57.

Costal fold absent. Head and thorax ocherous-brown. Ground colour of fore wing golden-lustrous with ocherous-brown basal patch, median band, and outer costal spot, and often sparsely irrorated with short, brownish, transverse striae, particularly in the apical region; basal patch faintly differentiated; median band distinct outwardly, broader toward posterior margin, and suffused outwardly with ground colour; fringe ocherous. Hind wing whitish, with slight fuscous shading posteriorly, and with short, fuscous, transverse striae in the outer half; fringe whitish. Expanse: 16-20 mm. Moth in February and March.

Male genitalia (Fig. 48).—Uncus broad-shouldered, apex rounded, short; socii absent; transtilla divided, coarsely dentate; aedeagus with four cornuti and with subapical teeth; sacculus broad, extending to outer margin of the broad, rounded clasper.

Female genitalia (Fig. 88).—Typical of the group. Sclerotized ribbon of the ductus bursae, as well as signum, absent.

Type locality.—San Francisco, California.

Type.—United States National Museum.

Food plant.—*Scrofularia californica* Cham.

Distribution.—San Francisco, Calif.

Remarks.—This form is very closely allied to *fucana* Wlsh., and may be only a subspecies. In general, *busckana* has darker wings than *fucana*. Until more is known of the distribution and behaviour of both forms, their relationship is obscure.

***Clepsis fucana* Walsingham (n. comb.)**

Fig. 181

Lozotaenia fucana Walsingham, 1879, Ill. Lepid. Het. 4: 12, Pl. 63, Fig. 2.*Tortrix fucana* Wlshm., Meyrick, 1913, Gen. Insect., Fasc. 149: 30.*Cacoecia victoriana* Busck, 1921, Can. Ent. 53: 278 (n. syn.).

Head and thorax ochereous or brownish. Costal fold absent. Fore wing light ochereous with reddish-brown median band and outer costal spot; median band almost straight on its inner side, and broadening considerably on its outer side to the end of the cell; a faint indication of a darker basal patch, veins at the outer margin faintly indicated by brown scales; light portions of wing containing a few indistinct, darker, short striae; fringe light ochereous. Hind wing entirely white. Undersurfaces of wings white, with disc of fore wing slightly fuscous. Expanse: 18-20 mm. Moth in July.

Male and female genitalia.—Inseparable from those of *busckana* Keifer.

Type locality.—Oregon (*fucana* Wlshm.); B.C. (*victoriana* Bsk.).

Type.—British Museum (*fucana* Wlshm.); United States National Museum (*victoriana* Bsk.).

Food plant.—Unknown.

Distribution.—Coastal B.C., and Oreg.

Remarks.—This is very close to the Californian species *busckana* Keif., but it is lighter in colour.

***Clepsis clemensiana* Fernald (n. comb.)**

Figs. 184-185

Tortrix (Lozotaenia) clemensiana Fernald, 1879, Can. Ent. 11: 155.*Tortrix nervosana* Kearfott, 1907, Trans. Am. Ent. Soc. 33: 71.*Archips clemensiana* Fern., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 481.*Tortrix clemensiana* Fern., Meyrick, 1913, Gen. Insect., Fasc. 149: 29.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 492.

Leonard, 1928, Cornell Univ. Agr. Expt. Sta., Mem. 101: 568.

Klots, 1942, Bull. Am. Mus. Nat. Hist. 79: 415.

Head and thorax light ochereous to tawny. Fore wing long and narrow, somewhat falcate in the female; male costal fold well developed, broadly arcuate behind, with elongate, whitish scales; fore wing entirely shining luteus, sometimes with veins outlined with slightly darker scales. Hind wing white, sometimes with fuscous scales in anal region; fringe white. Undersurfaces of wings whitish, sometimes with fuscous scales on disc of fore wing. Expanse: 20-23 mm. Moth in July, occasionally again in September.

Male genitalia (Fig. 50).—Uncus very short, broad, truncate; gnathos arms short, apices fused for a considerable distance; transtilla divided into two inward-projecting, serrate lobes; sacculus poorly defined along ventral margin of clasper; aedeagus short, broad, with four cornuti.

Female genitalia (Fig. 90).—Sterigma narrow and produced laterally into two short lobes; antrum short; ductus bursae with sclerotized ribbon throughout.

Type locality.—Type series from Maine, Mass., N.Y., Wis., (*clemensiana* Fern.); Winchendon, Mass. (*nervosana* Kft.).

Type.—United States National Museum (*clemensiana* Fern.); American Museum Natural History (*nervosana* Kft.).

Food plants.—Gramineae, *Solidago*.

Distribution.—N.S. to B.C., Maine, Pa., N.Y., N.H., Mass., Del., N.J., Ky., Iowa, Mo., Ill., Nebr., Calif.

Remarks.—Kearfott's *nervosana* appears to apply to browner specimens of *clemensiana* Fern. Kearfott compared it with *pallorana* Rob., which it super-

ficially resembles. Robinson's species, however, falls in the subfamily Tortricinae together with *alleniana* Fern., on the basis of genitalic characters.

***Clepsis melaleucana* Walker (n. comb.)**

Figs. 186-187

Lophoderus melaleucanus Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 335.

Conchylis invexana Walker, 1863, List Lepid. Ins. Brit. Mus. 28: 358.

Ptycholoma ? *semifuscana* Clemens, 1864, Proc. Ent. Soc. Phila. 3: 519.

Tortr. melaleucana Wlk., Robinson, 1869, Trans. Am. Ent. Soc. 2: 271, Pl. 4, Fig. 29.

Tortr. (Ptychol.) melaleucana Wlk., Zeller, 1875, Verh. zool.-bot., Ges. Wien 25: 223.

Ptycholoma melaleucanum Wlk., Walsingham, 1879, Ill. Lepid. Het. 4: 10, Pl. 62, Fig. 8.

Archips melaleucana Wlk., Fernald, 1902, in Dyar, List N. Am. Lepid., p. 481.

Dyar, 1904, Proc. U. S. N. M. 27: 930.

Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 498.

Cacoecia melaleucana Wlk., Meyrick, 1913, Gen. Insect., Fasc. 149: 25.

Judd, 1946, Can. Field Nat. 60: 136.

Costal fold of male extremely well developed, extending and gradually tapering to slightly beyond centre of costa. Head and thorax tawny. Fore wing with creamy-white costa and with light fawn spots containing metallic-bluish scales; basal third of costa fuscous in male, creamy-white in the female; separated by a narrow whitish area from the rest of the dark-coloured basal patch; a large, roundish, dark-brown blotch on the posterior margin near the tornus, containing metallic-bluish scales and bordered above with light fawn; between this blotch and basal patch, an upright bar of metallic scales; outer costal spot distinct; concolourous with large dorsal blotch, and surrounded by sordid white; apical portion of wing, and fringe, whitish or slightly ochreous. Hind wing fuscous, white along costa; fringe whitish with dark basal line. Expanse: male 19-22 mm.; female, 22-25 mm. Moth in May and early June.

Male genitalia (Fig. 51).—Uncus short, truncate; socii absent; transtilla divided, coarsely dentate; apex of clasper angular; sacculus well developed, its apex upturned, pointed, and extending slightly beyond outer margin of clasper; aedeagus cleft apically, dorsal portion finely dentate.

Female genitalia (Fig. 91).—Ostium large; antrum well-developed, bulbous; sclerotized ribbon present for entire length of ductus bursae.

Type locality.—North America, from Carter's Collection (*melaleucana* Wlk.); Nova Scotia (*invexana* Wlk.); Virginia (*semifuscana* Clem.).

Type.—British Museum (*melaleucana* Wlk., *invexana* Wlk.); Academy of Natural Sciences of Philadelphia (*semifuscana* Clem.).

Food plants.—*Trillium*, *Polygonatum*, *Caulophyllum*.

Distribution.—Southern Que. and Ont., Maine, to N.J., Pa.

Remarks.—The larvae may be collected in early May, when they tie together the leaves of the food plants. It is a common species.

***Clepsis moeschleriana* Wocke (n. comb.)**

Figs. 188-194

Tortrix moeschleriana Wocke, 1862, Stett. Ent. Zeit. 23: 45.

Tortrix algidana Moesch., 1862, Wien Ent. Mon. 6: 138.

Robinson, 1869, Trans. Am. Ent. Soc. 2: 272, Pl. 5, Fig. 32.

Tortrix gelidana Moeschler, 1862, Wien Ent. Mon. 6: 138, Pl. 1, Fig. 9.

Packard, 1869, Guide Stud. Ins., p. 334.

Capua moeschleriana Wocke, Meyrick, 1913, Gen. Insect., Fasc. 149: 15.

Cnephasia moeschleriana Wocke, Forbes, 1923, Cornell Univ. Agr. Expt. Sta., Mem. 68: 488.

Costal fold of male absent. Fore wing rather narrow. Head and thorax tawny. Fore wing ochreous, with reddish-brown basal patch, median band, and outer costal spot; basal patch twice as wide at posterior margin as at costa; sometimes reduced on costa, rarely entirely absent; median band narrow, con-

stricted in the cell, distinctly outlined; rarely this band divided into three portions: a central costal spot, a discal spot, and a tornal spot; outer costal spot very close to apex of wing and more often appearing as an inward-projecting spur; light ochereous areas of wing uniformly sprinkled with fine, reddish-brown, transverse striae; fringe light ochereous. Hind wing uniformly dark fuscous with white fringe. Expanse: 15-22 mm. Moth in July and August.

Male genitalia (Fig. 52).—Uncus short, broad; arms of gnathos considerably fused and somewhat elbowed; transtilla divided, coarsely and thickly dentate, each division of transtilla tusk-like; sacculus produced ventrally into a large lobe and terminating in a long, thin, recurved apex.

Female genitalia (Fig. 92).—Sterigma narrow, produced into two lateral arms; ostium small; antrum short, tubular; ductus bursae entirely membranous.

Type locality.—Labrador (*moeschleriana* Wocke; *algidana* Moesch.).

Type.—Leningrad ?

Food plant.—Unknown.

Distribution.—Labr. to Alaska; Banff, Alta.; Man.; Mount Washington, N.H.

Remarks.—This species varies much in colour and maculation. The ground colour may be yellowish-ochereous, ochereous-fuscous, ochereous-tawny, or tawny-fuscous. The bands and spots become more indistinct as the ground colour becomes darker.

***Clepsis flavidana* McDunnough (n. comb.)**

Fig. 195

Tortrix flavidana McDunnough, 1923, Can. Ent. 55: 168.

Male.—Unknown.

Female.—Head and thorax ochereous-yellow. Ground colour of fore wing ochereous-yellow with dark purple blotches as follows: one in middle of wing near base, one in lower part of cell, and one at tornus, sometimes all three united into one elongate blotch; also one representing the outer costal spot; hind margin of wing sometimes with short, purple striations. Hind wing yellow-white, shaded with fuscous inwardly. Expanse: female, 26 mm. Moth in July.

Female genitalia (Fig. 93).—Ostium large; sterigma grooved; antrum heart-shaped; ductus bursae with sclerotized ribbon in ostial half.

Type locality.—Aweme, Manitoba.

Type.—Canadian National Collection, Ottawa, Canada.

Food plant.—Unknown.

Distribution.—Known only from Aweme, Winnipeg, and Westbourne, Man.

Remarks.—This is a rare moth and is known only from five females. It is placed tentatively in the genus *Clepsis* Gn., pending the capture of a male.

SUMMARY

The North American species of the subfamily Archipinae are placed in ten genera. The generic name *Tortrix* Linn., which has been associated with some of these species for many years, is not applicable as has been previously suggested by Busck (1940, Bull. Calif. Acad. Sci. 39: 87-98). *Archippus* nov. gen. is described for some species formerly placed in *Tortrix* Linn., *Archips* Hbn. or *Cacoecia* Hbn. The generic names *Choristoneura* Led., *Syndemis* Hbn., *Ptycholoma* Steph., and *Clepsis* Gn., originally proposed for European species, have been employed. The specific names listed in McDunnough's Check List (1939) under *Archips* Hbn. and *Tortrix* Linn., and not included in this paper, apply to species of the subfamily Tortricinae. The species listed as *Tortrix baboquavariana* Kft. belongs in the family Phalonüidae, and it is possible that a few species now included in that family will eventually be placed in the Tortricidae.

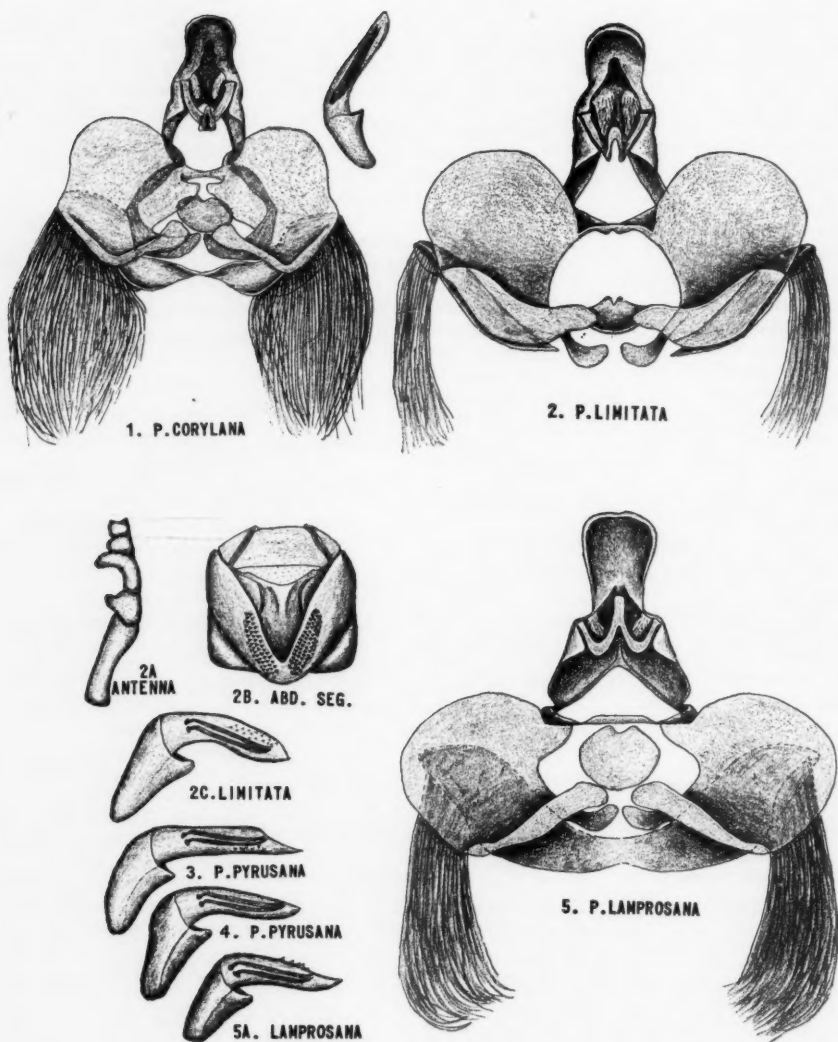
Pandemi
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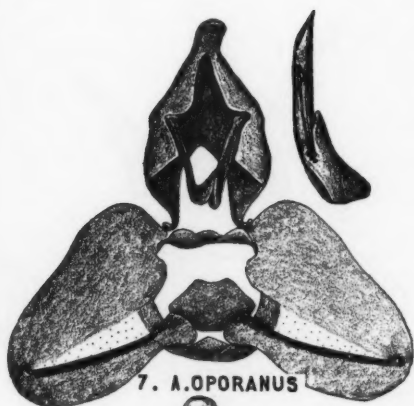
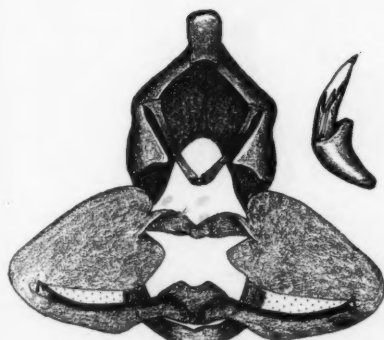
CHECK LIST OF THE NORTH AMERICAN SPECIES OF THE SUBFAMILY ARCHIPINAE

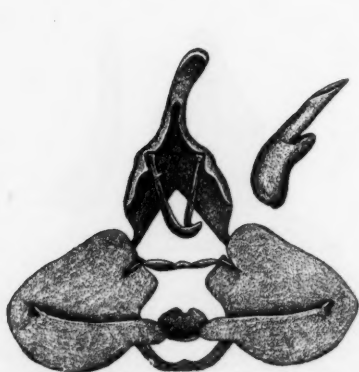
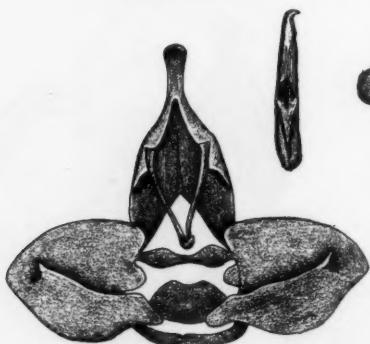
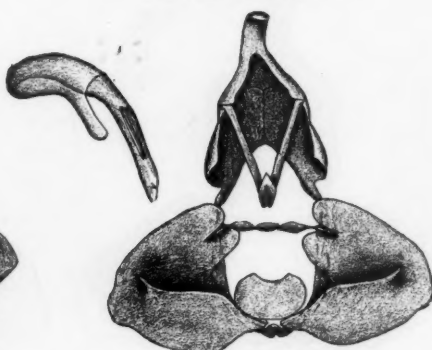
Following is a list of the genera and species considered in this paper:

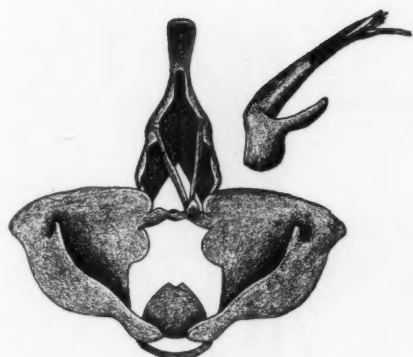
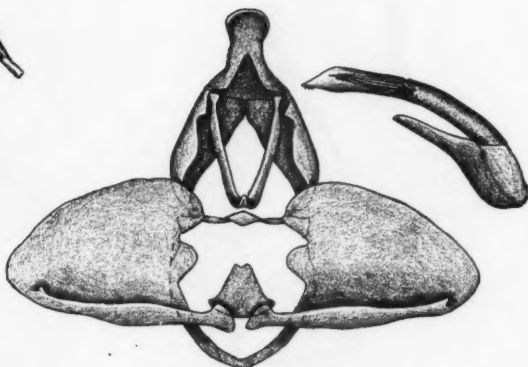
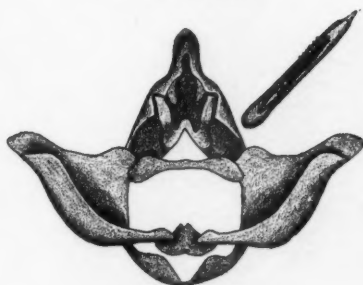
- Pandemis* Hbn.
lamprosana Rob.
pyrusana Kft.
 syn. *pyrana* Meyr.
limitata Rob.
canadana Kft.
- Archippus* nov. gen.
oporanus Linn.
 syn. *podanus* Scop.
striatus Fern.
alberta McD.
dissitanus Grt.
packardianus Fern.
- Archips* Hbn.
infumatus Zell.
semiferanus Wlk.
 syn. *flaccidus* Rob.
negundanus Dyar
cerasivoranus Fitch
 subsp. *rileyanus* Grt.
 homo. *fervidus* Wlk.
fervidus Clem.
 syn. *paludatus* Rob.
argyrospilus Wlk.
 syn. *furvus* Rob.
 syn. *v-signatus* Pack.
 subsp. *vividus* Dyar
 subsp. *columbianus* McD.
eleagnus McD.
mortuanus Kft.
myricanus McD.
rosanus Linn.
 syn. *hewittanus* Bsk.
georgianus Wlk.
griseus Rob.
 syn. *braunianus* Kft.
magnolianus Fern.
purpuranus Clem.
 syn. *gurgitanus* Rob.
 syn. *lintnerianus* Grt.
- Choristoneura* Led.
pinus Free.
- fumiferana* Clem.
 syn. *nigridia* Rob.
lambertiana Bsk.
canana B. & Bsk.
retiniana Wlshm.
conflictana Wlk.
fractivittana Clem.
 syn. *fumosa* Rob.
houstonana Grt.
 syn. *retana* Wlshm.
albaniana Wlk.
 syn. *arctica* Moesch.
 syn. *kukakana* Kft.
rosaceana Harr.
 syn. *vicariana* Wlk.
 syn. *gossypiana* Pack.
parallela Rob.
obsoletana Wlk.
 syn. *transiturana* Wlk.
 syn. *vesperana* Clem.
 syn. *sanbornana* Clem.
zapulata Rob.
 syn. *symphoricarpana* Kft.
seminolana Kft.
- Syndemis* Hbn.
afflictana Wlk.
 syn. *fuscolineana* Clem.
- Argyrotaenia* Steph.
velutinana Wlk.
 syn. *triferana* Wlk.
 syn. *incertana* Clem.
 syn. *lutosana* Clem.
repertana Free.
pinatubana Kft.
occultana Free.
mariana Fern.
tabluana Free.
citrana Fern.
niscana Kft.
 syn. *camerata* Meyr.
coloradana Fern.
quadrifasciana Fern.
- quercifolia* Fitch
 syn. *trifurculana* Zell.
juglandana Fern.
amatana Dyar
alisellana Rob.
gloverana Wlshm.
ivana Fern.
purata Meyr.
franciscana Wlshm.
provana Kft.
 syn. *invidana* B. & Bsk.
dorsalana Dyar
 syn. *dimorphana* B. & Bsk.
- Batodes* Gn.
 angustiorana Haw.
- Adoxophyes* Meyr.
furcatana Wlk.
negundana McD.
- Ptycholoma* Steph.
 syn. *Smicrotes* Clem.
peritana Clem.
 syn. *inconclusana* Wlk.
virescana Clem.
 syn. *sescuplana* Zell.
glauca Wlshm.
- Clepsis* Gn.
persicana Fitch
 syn. *blandana* Clem.
 syn. *fragaria* Pack.
 syn. *conigerana* Zell.
fucana Wlshm.
 syn. *victoriana* Bsk.
busckana Keif.
clemensiana Fern.
 syn. *nervosana* Kft.
melaleucana Wlk.
 syn. *invexana* Wlk.
 syn. *semifuscana* Clem.
moeschleriana Wocke
 syn. *algidana* Moesch.
 syn. *gelidana* Moesch.
flavidana McD.



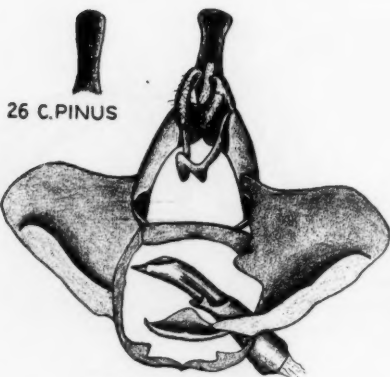
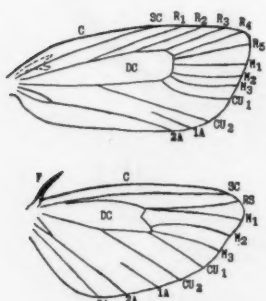
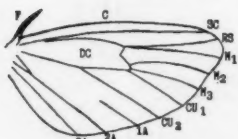
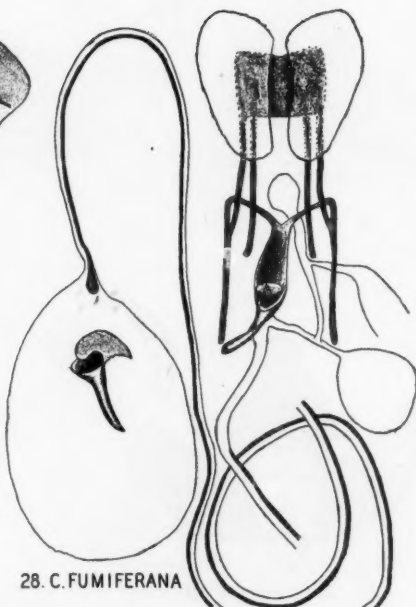
Figs. 1-5. Male genitalia, antenna and first abdominal segment of *Pandemis* spp.

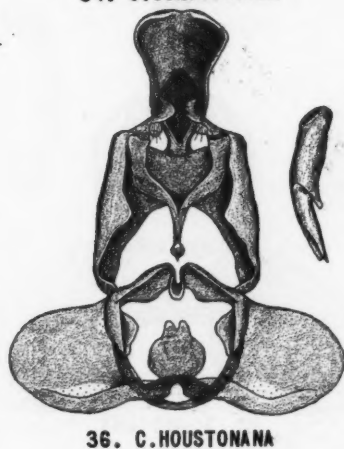
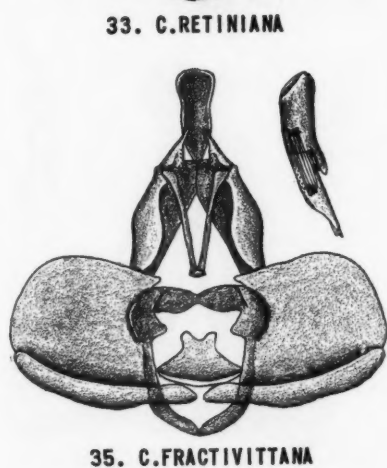
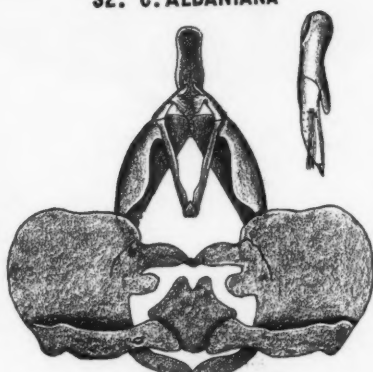
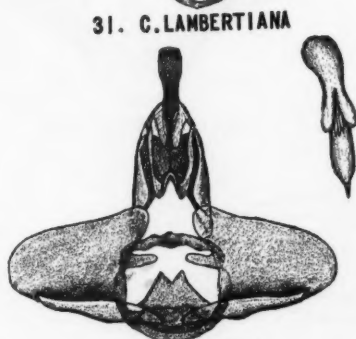
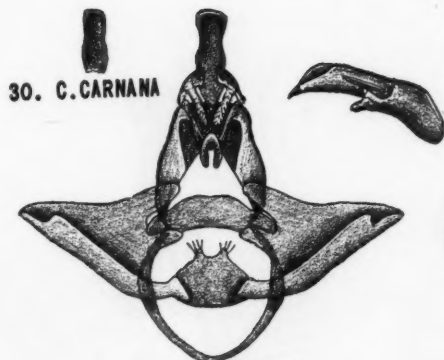
6. *A. PICEANUS*7. *A. OPORANUS*8. *A. STRIANUS*9. *A. ALBERTA*10. *A. DISSITANUS*11. *A. PACKARDIANUS*Figs. 6-11. Male genitalia of *Archippus* spp.

12. *A. XYLOSTEANUS*13. *A. INFUMATUS*14. *A. SEMIFERANUS*15. *A. CERASIVORANUS*16. *A. ARGYROSPILUS*17. *A. FERVIDANUS*Figs. 12-17. Male genitalia of *Archips* spp.

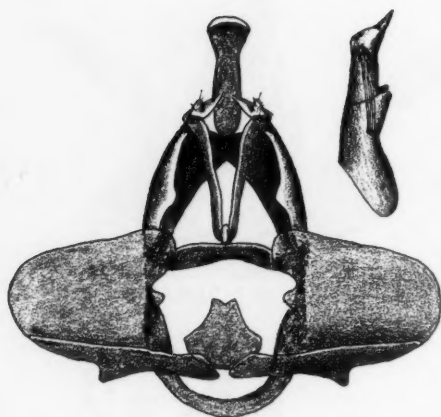
18. *A. ROSANUS*19. *A. GEORGIANUS*20. *A. GRISEUS*21. *A. PURPURANUS*22. *B. ANGUSTIORANA*23. *S. AFFLICTANA*

Figs. 18-23. Male genitalia of *Archips* spp., *Batodes* sp. and *Syndemis* sp.

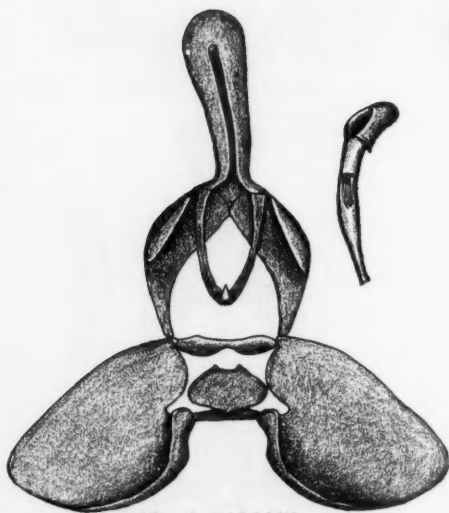
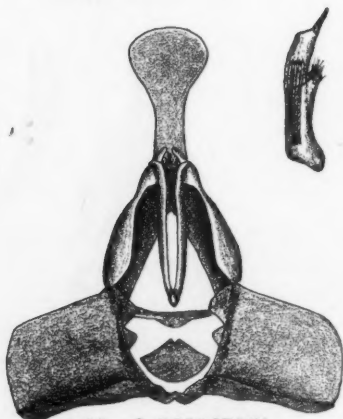
24. *C. DIVERSANA*25. *C. DIVERSANA*26. *C. PINUS*27. *C. FUMIFERANA*29. *C. FUMIFERANA*28. *C. FUMIFERANA*Figs. 24-29 Male and female genitalia and wing venation of *Choristoneura* spp.



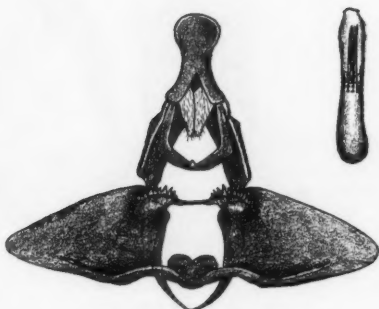
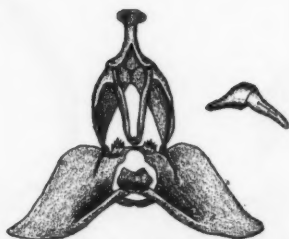
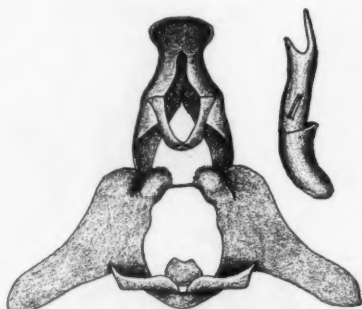
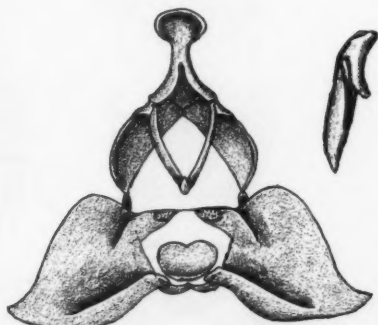
Figs. 30-36. Male genitalia of *Choristoneura* spp.

37. *C. PARALLELA*38. *C. OBSOLETANA*

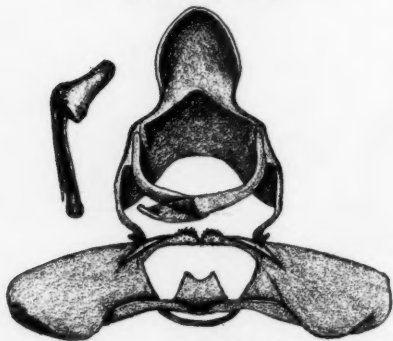
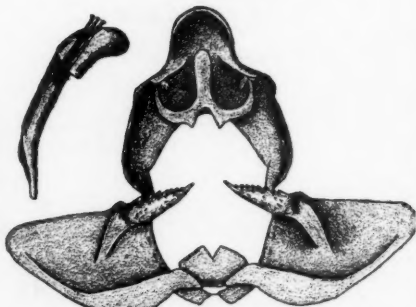
38A

39. *C. ZAPULATA*40. *A. MARIANA*41. *C. ROSACEANA*

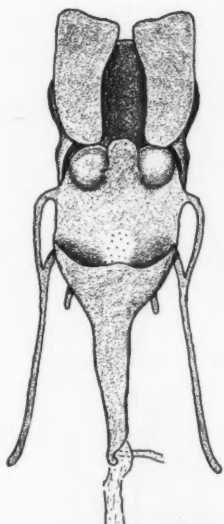
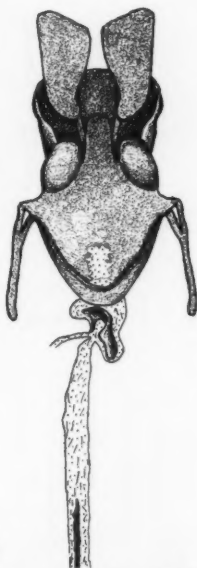
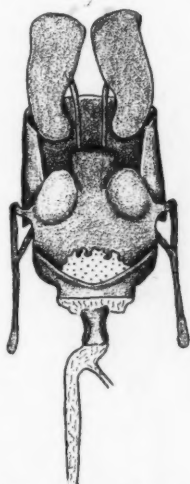
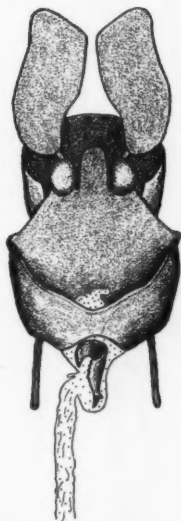
Figs. 37-41. Male genitalia of *Choristoneura* spp. and *Argyrotaenia* sp.

42. *A. HETEROIDANA*43. *A. FURCATANA*44. *P. PERITANA*45. *P. LECHEANA*46. *P. GLAUCANA*

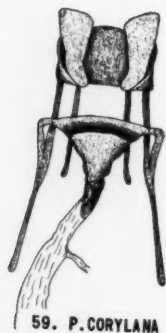
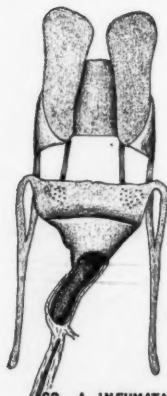
Figs. 42-46. Male genitalia of *Adoxophyes* spp. and *Ptycholoma* spp.

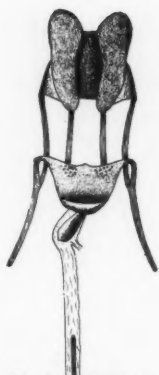
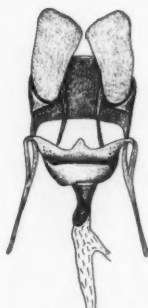
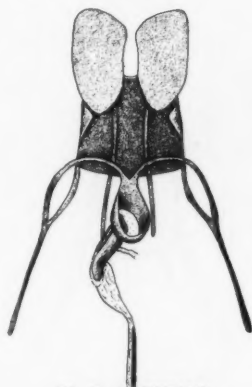
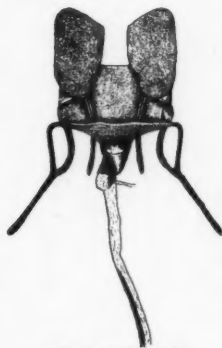
47. *C. RUSTICANA*48. *C. BUSCKANA*49. *C. PERSICANA*50. *C. CLEMENSIANA*51. *C. MELALEUCANA*52. *C. MOESCHLERIANA*

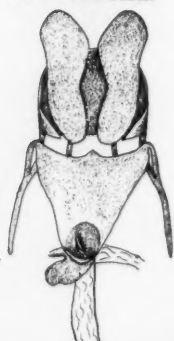
Figs. 47-52. Male genitalia of *Clepsis* spp.

53. *A. PICEANUS*54. *A. OPORANUS*55. *A. STRIANUS*56. *A. ALBERTA*57. *A. DISSITANUS*58. *A. PACKARDIANUS*

Figs. 53-58. Female genitalia of *Archippus* spp.

59. *P. CORYLANA*60. *P. LIMITATA*61. *A. XYLOSTEANUS*62. *A. INFUMATUS*63. *A. SEMIFERRANUS*64. *A. CERASIVORANUS*65. *A. ARGYROSPIILUS*66. *A. FERVIDANUS*67. *A. ROSANUS*Figs. 59-67. Female genitalia of *Pandemis* spp. and *Archips* spp.

68. *A. GEORGIANUS*69. *A. GRISEUS*70. *A. MAGNOLIANUS*71. *A. PURPURANUS*72. *S. AFFLICTANA*73. *C. FRACTIVITTANA*74. *C. LAMBERTIANA*75. *C. ALBANIANA*76. *C. CONFLICTANA*Figs. 68-76. Female genitalia of *Archips* spp., *Syndemis* sp., and *Choristoneura* spp.

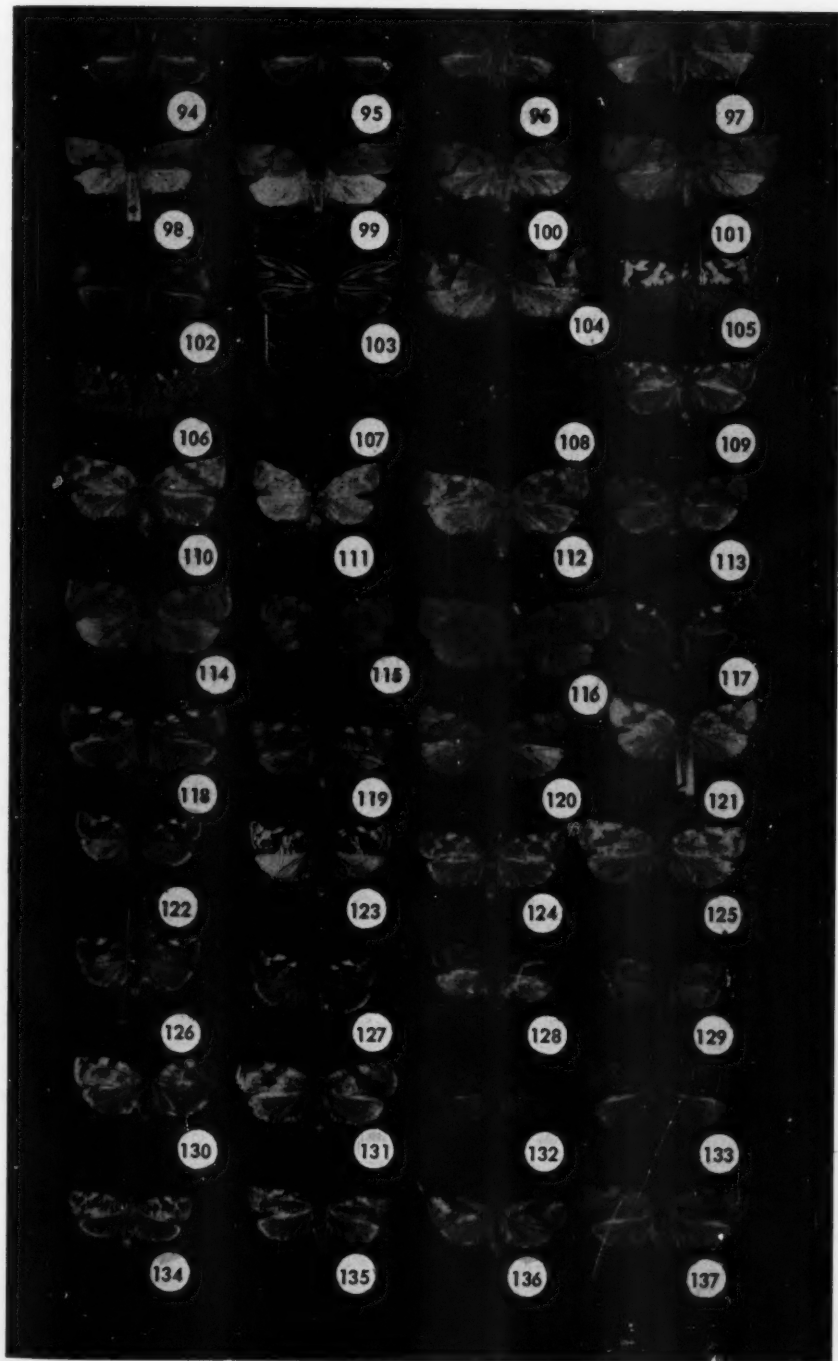
77. *C. HOUSTONANA*78. *C. ROSACEANA*79. *C. OBSOLETANA*80. *C. PARALLELA*81. *B. ANGUSTIORANA*82. *A. MARIANA*83. *P. LECHEANA*84. *P. GLAUCANA*85. *P. PERITANA*

Figs. 77-85. Female genitalia of *Choristoneura* spp., *Batodes* sp., *Argyrotaenia* sp., and *Ptycholoma* spp.

86. *A. HETEROIDANA*87. *A. FURCATANA*88. *C. BUSCKANA*89. *C. PERSICANA*90. *C. CLEMENSIANA*91. *C. MELALEUCANA*92. *C. MOESCHLERIANA*93
*C. FLAVIDANA*Figs. 86-93. Female genitalia of *Odoxophyes* spp. and *Clepsis* spp.

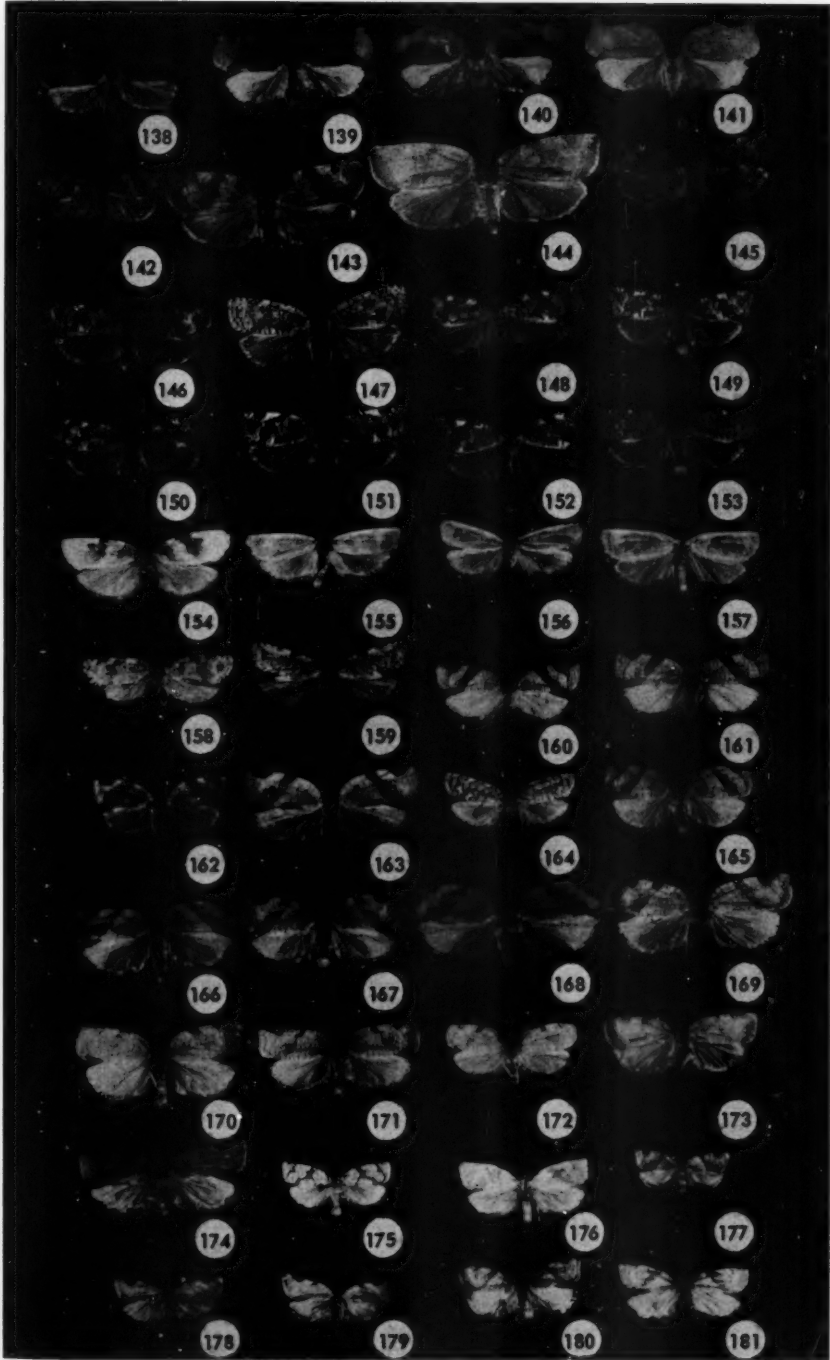
Figs. 94-137, Adults of *Pandemis*, *Archippus* and *Archips* spp.

94. *Pandemis canadana* Kft., male, Riding Mt. Park, Man.
95. *P. canadana* Kft., female, Riding Mt. Park, Man.
96. *P. limitata* Rob., male, Annapolis Royal, N.S.
97. *P. limitata* Rob., female, Tuxedo, N.Y.
98. *P. pyrusana* Kft., male, Sacramento, Calif.
99. *P. pyrusana* Kft., female, Seton Lake, B.C.
100. *P. lamprosana* Rob., male, Pt. Rowan, Ont.
101. *P. lamprosana* Rob., female, Ottawa, Ont.
102. *Archippus oporanthus* Linn., male, Vancouver, B.C.
103. *A. strianus* Fern., male, Laniel, Que.
104. *A. alberta* McD., male, Nordegg, Alta., paratype.
105. *A. dissistans* Grt., male, Meach Lake, Que.
106. *A. packardianus* Fern., male, Ottawa, Ont.
107. *Archips infumatus* Zell., male, Dallas, Tex.
108. *A. infumatus* Zell., female, Dallas, Tex.
109. *A. semiferanus* Wlk., male, Tuxedo, N.Y.
110. *A. semiferanus* Wlk., female, Simcoe, Ont.
111. *A. negundanus* Dyar, male, Aweme, Man.
112. *A. negundanus* Dyar, female, Aweme, Man.
113. *A. cerasivoranus* Fitch, male, Ottawa, Ont.
114. *A. cerasivoranus* Fitch, female, Ottawa, Ont.
115. *A. cerasivoranus rileyanus* Grt., male, Boxar Co., Tex.
116. *A. cerasivoranus rileyanus* Grt., female, Longview, Miss.
117. *A. argyrosipilus* Wlk., male, Aylmer, Que.
118. *Archips argyrosipilus* Wlk., female, Bobcaygeon, Ont.
119. *A. argyrosipilus vividanus* Dyar, male, Denver, Colo., paratype.
120. *A. argyrosipilus vividanus* Dyar, female, Denver, Colo., paratype.
121. *A. argyrosipilus columbianus* McD., female, Nelson, B.C.
122. *A. mortuanus* Kft., male, Blackburn, Ont.
123. *A. mortuanus* Kft., female, Blackburn, Ont.
124. *A. eleagnanus* McD., male, Aweme, Man., paratype.
125. *A. eleagnanus* McD., female, Aweme, Man., paratype.
126. *A. myricanus* McD., male, Brackley Beach, P.E.I.
127. *A. myricanus* McD., male, Algonquin Park, Ont., paratype.
128. *A. myricanus* McD., female, Brackley Beach, P.E.I.
129. *A. myricanus* McD., female, Brackley Beach, P.E.I.
130. *A. fervidanus* Clem., male, Grand Bend, Ont.
131. *A. fervidanus* Clem., female, Norway Bay, Que.
132. *A. rosanus* Linn., male, Digby, N.S.
133. *A. rosanus* Linn., female, Baddeck, N.S.
134. *A. georgianus* Wlk., male, New Lisbon, N.J.
135. *A. georgianus* Wlk., female, New Lisbon, N.J.
136. *A. griseus* Rob., male, Tuxedo, N.Y.
137. *A. griseus* Rob., female, Tuxedo, N.Y.



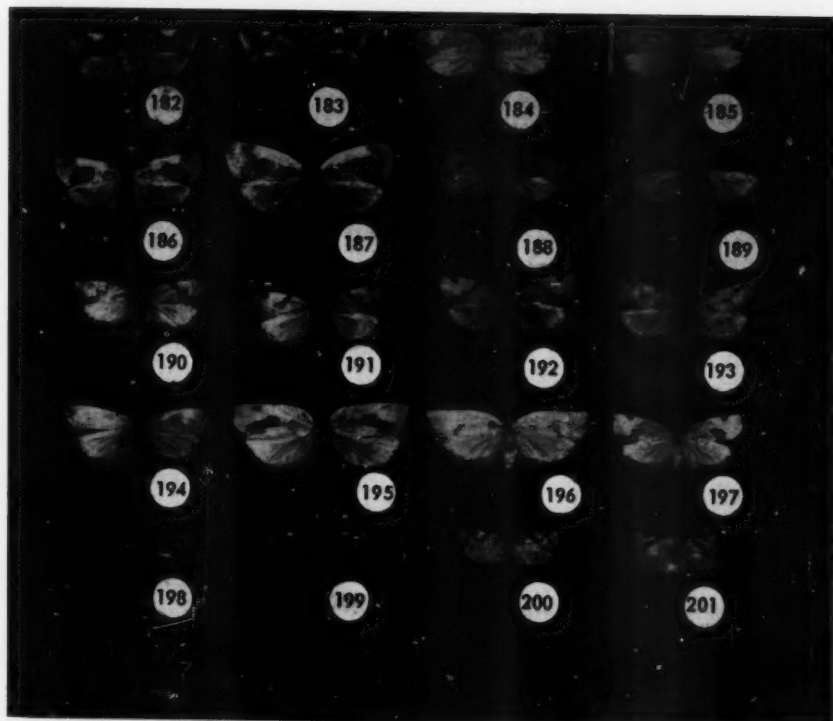
Figs. 138-181. Adults of *Archips*, *Syndemis*, *Choristoneura*, *Adoxophyes*, *Ptycholoma* and *Clepsis* spp.

138. *A. purpuranus* Clem., male, Tracadie, N.B.
139. *A. purpuranus* Clem., male, Mer Bleue, Ont.
140. *A. purpuranus* Clem., female, Vineland Station, Ont.
141. *A. purpuranus* Clem., female, Ottawa, Ont.
142. *Syndemis afflictana* Wlk., male, Smoky Falls, Ont.
143. *Choristoneura conflictana* Wlk., male, Nordegg, Alta.
144. *C. conflictana* Wlk., female, Norway Bay, Que.
145. *C. fumiferana* Clem., male, Bells Corners, Ont.
146. *C. fumiferana* Clem., male, Norway Bay, Que.
147. *C. fumiferana* Clem., female, Bells Corners, Ont.
148. *C. fumiferana* Clem. complex, male, Lillooet, B.C.
149. *C. pinus* Free., male, Franz, Ont.
150. *C. pinus* Free., female, MacDiarmid, Ont.
151. *C. pinus* Free., female, Nicholson, Ont.
152. *C. fumiferana* Clem. complex, male, Lillooet, B.C.
153. *C. fumiferana* Clem. complex, male, New Lisbon, N.J.
154. *C. carnana* B. & Bsk., male, Camp Baldy, San Bernardino Mts., Calif.
155. *C. fumiferana* Clem. complex, male, Golden, Colo.
156. *C. fumiferana* Clem. complex, male, Sugar Loaf, Colo.
157. *C. fumiferana* Clem. complex, male, Modoc Co., Calif.
158. *C. lambertiana* Bsk., female, Ashland, Oreg.
159. *C. retiniana* Wlshm., male, Mono Co., Calif.
160. *C. albaniana* Wlk., male, Smoky Falls, Ont.
161. *C. albaniana* Wlk., female, Churchill, Man.
162. *C. fractivittana* Clem., male, Simcoe, Ont.
163. *C. fractivittana* Clem., female, Merivale, Ont.
164. *C. houstonana* Grt., male, Paradise, Ariz.
165. *C. parallela* Rob., male, New Lisbon, N.J.
166. *C. parallela* Rob., female, Bobcaygeon, Ont.
167. *C. rosaceana* Harr., male, Bobcaygeon, Ont.
168. *C. rosaceana* Harr., female, Blackburn, Ont.
169. *C. zapulata* Rob., male, Aweme, Man.
170. *C. zapulata* Rob., male, Constance Bay, Ont.
171. *C. zapulata* Rob., male, Kazabazua, Que.
172. *C. seminolana* Kft., male, Okefenokee Swamp, Ga.
173. *C. obsoletana* Wlk., male, Pokemouche, N.B.
174. *C. obsoletana* Wlk., female, White Pt. Beach, N.S.
175. *Adoxophyes furcatana* Wlk., male, Pt. Rowan, Ont.
176. *A. negundana* McD., male, Indian Head, Sask.
177. *Ptycholoma peritana* Clem., male, Alberton, P.E.I.
178. *P. virescens* Clem., female, Bobcaygeon, Ont.
179. *P. glaucana* Wlshm., female, Waterton Lakes, Alta.
180. *Clepsis busckiana* Keif., female, San Francisco, Calif., paratype.
181. *C. fucana* Wlshm., male, Victoria, B.C.



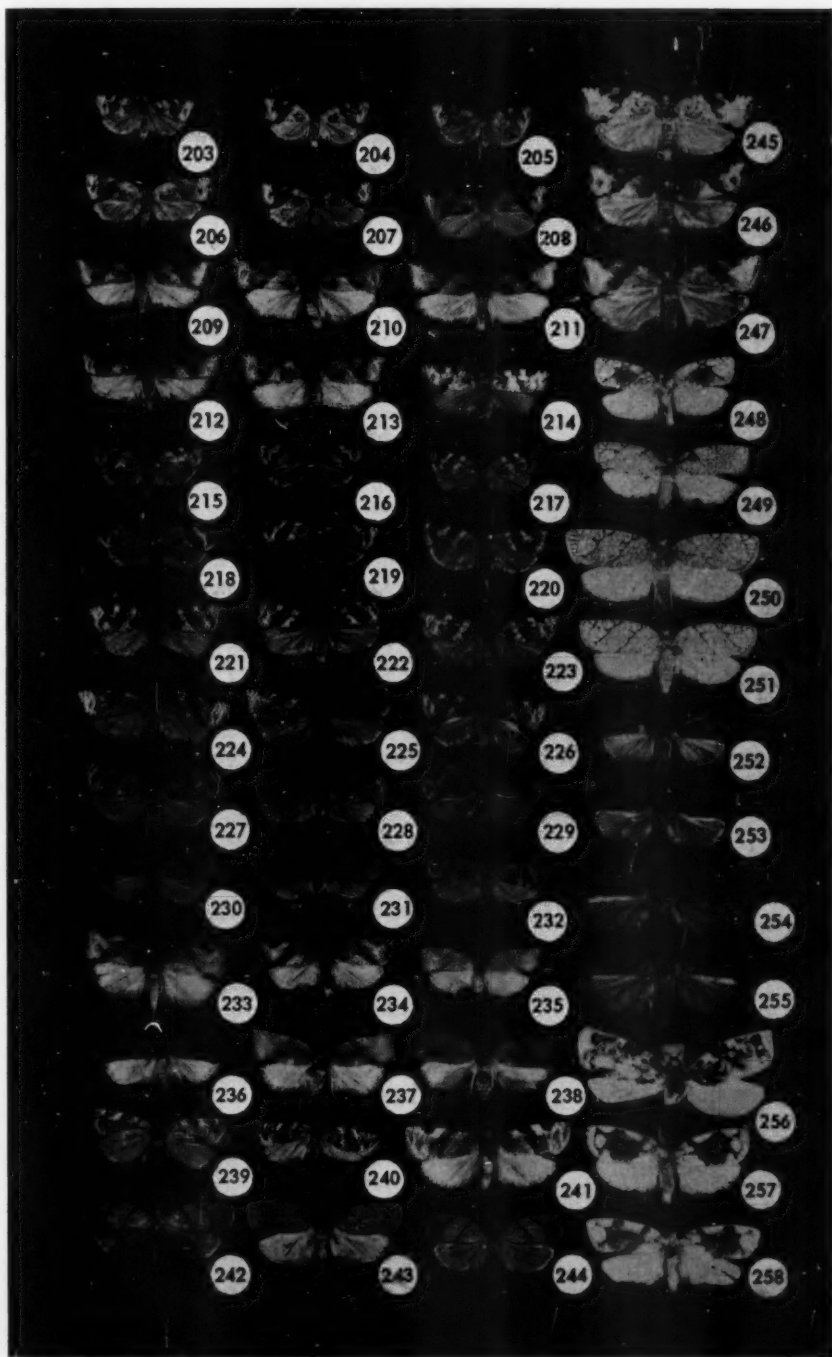
Figs. 182-202. Adults of *Clepsis*, *Argyrotaenia* and *Batodes* spp., and abdominal pits of *Archippus* sp.

182. *Clepsis persicana* Fitch, male, Ottawa, Ont.
183. *C. persicana* Fitch, male, Waterton Lakes, Alta.
184. *C. clemensiana* Fern., male, Simcoe, Ont.
185. *C. clemensiana* Fern., male, Baddeck, N.S.
186. *C. melaleucana* Wlk., male, Norway Bay, Que.
187. *C. melaleucana* Wlk., female, Brome, Que.
188. *C. moeschleriana* Wke., male, Mt. Washington, N.H.
189. *C. moeschleriana* Wke., male, Churchill, Man.
190. *C. moeschleriana* Wke., male, Hopedale, Labrador.
191. *C. moeschleriana* Wke., male, Hopedale, Labrador.
192. *C. moeschleriana* Wke., male, St. Paul Is., Alaska.
193. *C. moeschleriana* Wke., male, St. Paul Is., Alaska.
194. *C. moeschleriana* Wke., male, St. Paul Is., Alaska.
195. *C. flavidana* McD., female, Westbourne, Man.
196. *Argyrotaenia dorsalana* Dyar, female, Duncan, Vancouver Is., B.C., paratype.
197. *A. dorsalana* Dyar, male, Kaslo, B.C.
198. *Batodes angustiorana* Haw., male, Victoria, B.C.
199. *B. angustiorana* Haw., female, Victoria, B.C.
200. *Argyrotaenia ivana* Fern., male, Royal Palm Park, Fla.
201. *A. franciscana* Wlshm., male, San Francisco, Calif.
202. Dorsal abdominal pits of *Archippus dissitanus* Grt.



Figs. 203-258. Adults of *Argyrotaenia* spp.

203. *A. velutinana* Wlk., male, Constance Bay, Ont.
204. *A. velutinana* Wlk., male, Mer Bleue, Ont.
205. *A. velutinana* Wlk., male, Ottawa, Ont.
206. *A. velutinana* Wlk., female, Meach Lake, Que.
- 207, 208. *A. velutinana* Wlk., females, Ottawa, Ont.
209. *A. repertana* Free., female, holotype, Waweig, N.B.
210. *A. repertana*, Free., male, paratype, Augusta, Maine.
211. *A. repertana*, Free., male, paratype, Aweme, Man.
212. *A. repertana*, Free., male, allotype, St. Andrews, N.B.
213. *A. repertana*, Free., female paratype, White Pt. Beach, N.S.
214. *A. provana* Kft., male, Victoria, B.C.
215. *A. pinatubana* Kft., male, Chelsea, Que.
216. *A. pinatubana* Kft., male, Wright, Que.
217. *A. pinatubana* Kft., male, Chelsea, Que.
218. *A. pinatubana* Kft., female, S. Milford, N.S.
219. *A. pinatubana* Kft., female, Tabusintac, N.B.
220. *A. pinatubana* Kft., female, Ottawa, Ont.
221. *A. occultana* Free., male, holotype, Mt. Lyall, Que.
222. *A. occultana* Free., male, Mt. Laurier, Que.
223. *A. occultana* Free., male, paratype, Mer Bleue, Ont.
224. *A. occultana* Free., female, allotype, Mt. Lyall, Que.
225. *A. occultana* Free., female, paratype, Burbridge, Que.
226. *A. occultana* Free., female, paratype, McAdam, N.B.
227. *A. tabulana* Free., female, holotype, Constance Bay, Ont.
- 228, 229. *A. tabulana* Free., males, paratypes, Biscotasing, Ont.
230. *A. tabulana* Free., female, allotype, Kazabazua, Que.
- 231, 232. *A. tabulana* Free., females, paratypes, Peachland, B.C.
233. *A. citrana* Fern., male, Riverside, Calif.
- 234, 235. *A. citrana* Fern., males, Victoria, B.C.
- 236, 237. *A. citrana* Fern., females, Ladysmith, B.C.
238. *A. citrana* Fern., female, Victoria, B.C.
- 239, 240. *A. niscana* Kft., females, Cajon Valley, Calif.
241. *A. coloradana* Fern., male, Estes Park, Colo.
242. *A. quadrifasciana* Fern., male, Norway Bay, Que.
243. *A. quadrifasciana* Fern., female, Meach Lake, Que.
244. *A. quadrifasciana* Fern., male, Bobcaygeon, Ont.
245. *A. mariana* Fern., male, Ottawa, Ont.
246. *A. mariana* Fern., male, Berwick, N.S.
247. *A. mariana* Fern., female, Annapolis Royal, N.S.
248. *A. quercifoliana* Fitch, male, Aweme, Man.
249. *A. quercifoliana* Fitch, female, Simcoe, Ont.
250. *A. quercifoliana* Fitch, female, Meach Lake, Que.
251. *A. quercifoliana* Fitch, female, Ottawa, Ont.
- 252, 253. *A. juglandana* Fern., males, Simcoe, Ont.
- 254, 255. *A. juglandana* Fern., females, Simcoe, Ont.
256. *A. amatana* Dyar, female, Perrine, Fla. (From photo).
- 257, 258. *A. alisellana* Rob., males, Mt. Lake, Va.



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